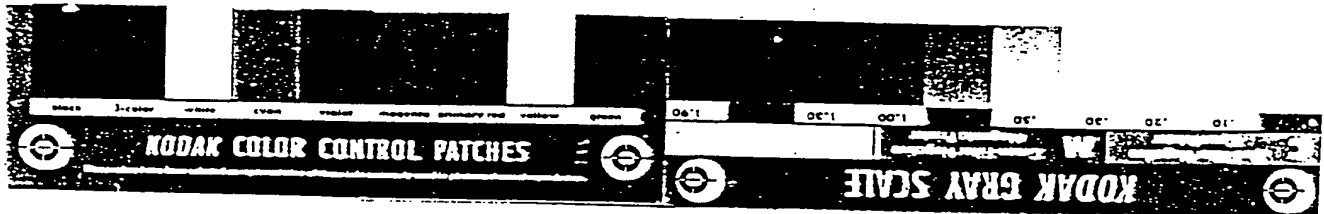


Fig. 1

Color comparison of various passive layers



Substrate: Zinc-plated screws

Blue chromation: Left picture half

Invention: Center

Yellow chromation: Right picture half

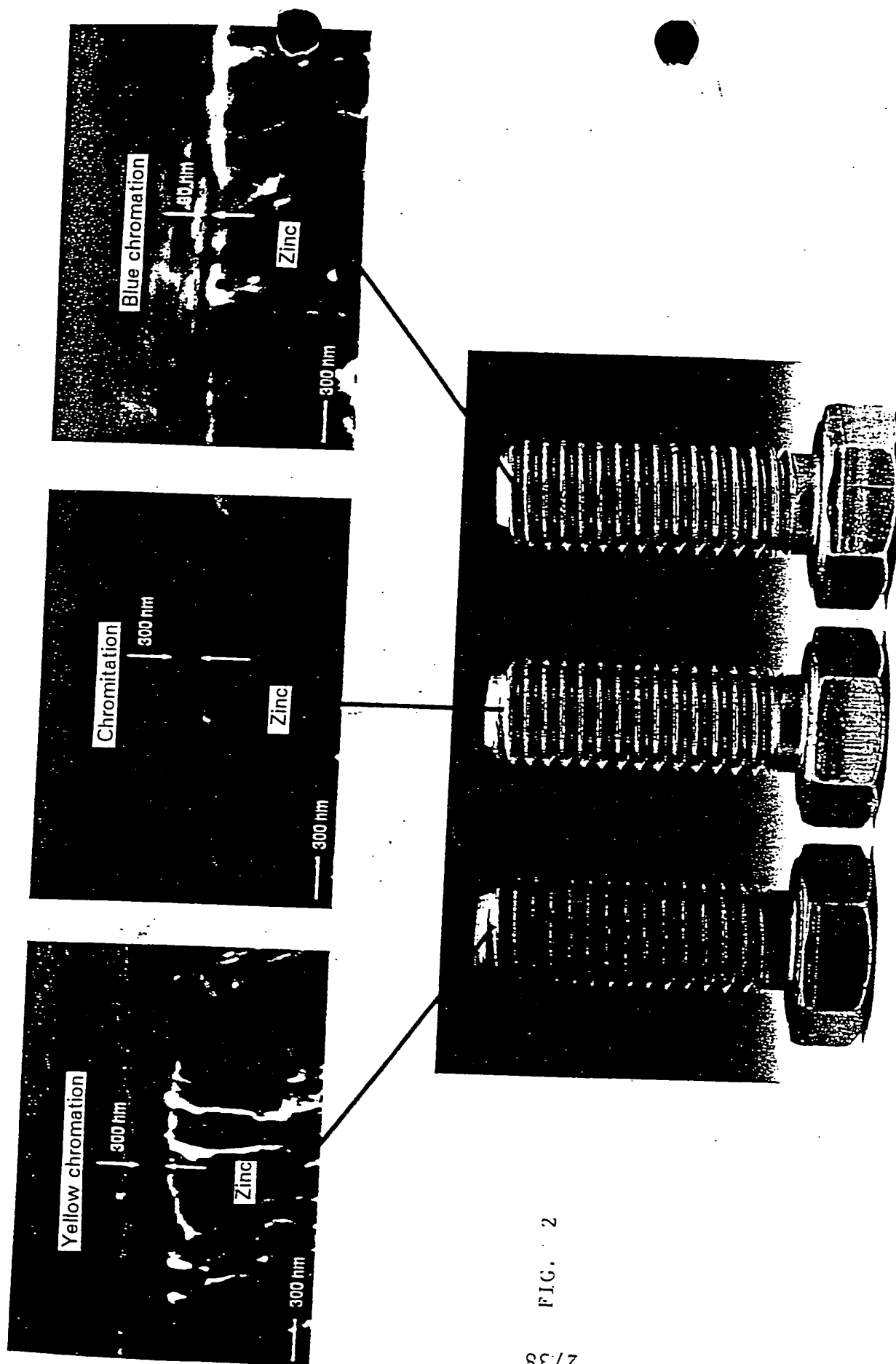


FIG. 2

Fig. 3

Bandwidth of iridescence according to the present invention
(on zinc-plated screws)

09004993-071304

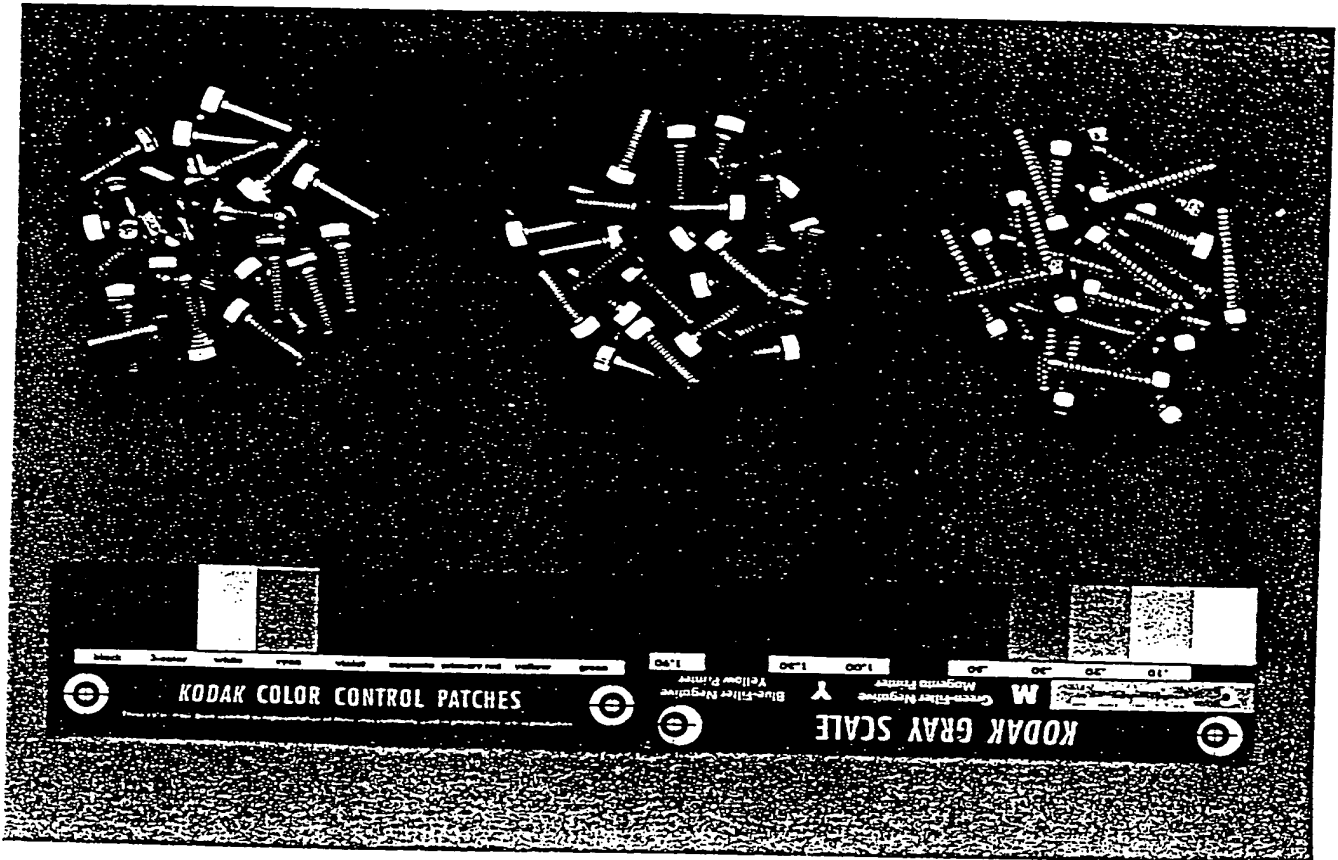


Fig. 4

Comparison test with EP 0 034 040

Example 16

Example 17

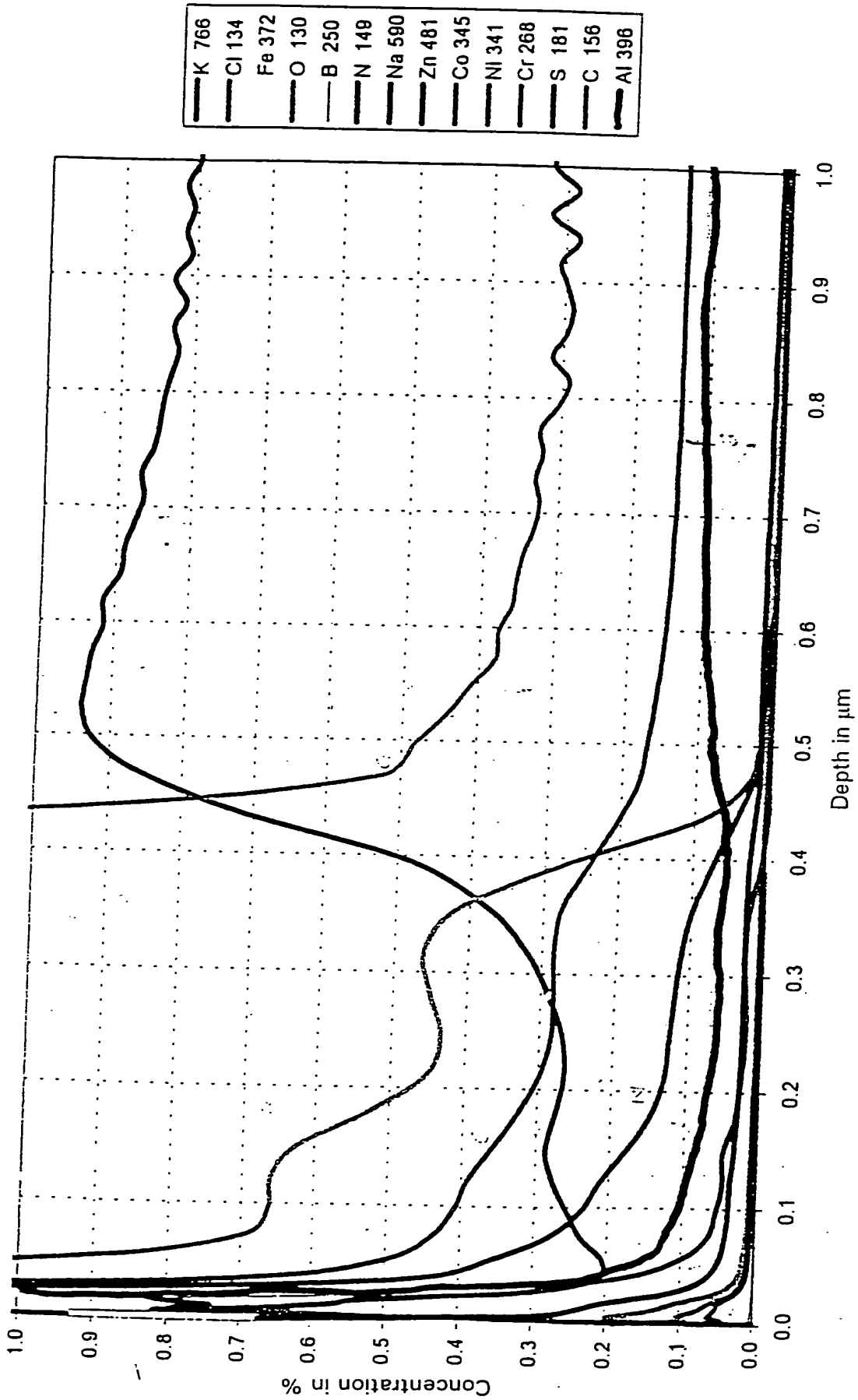


The upper picture half, one the outer left and right, shows a black cloth whereby the abrasions on the metal sheets shown in the top picture half were obtained. Layer portions - discernible as whitish stains - are on both pieces of cloth. The lower picture half shows the unmarred layers of the prior art.

Substrate: Zinc-plated steel sheet.

FIG. 5

Pattern 1, Measurement Position A



TID 25570660

Pattern 1, Measurement Position A

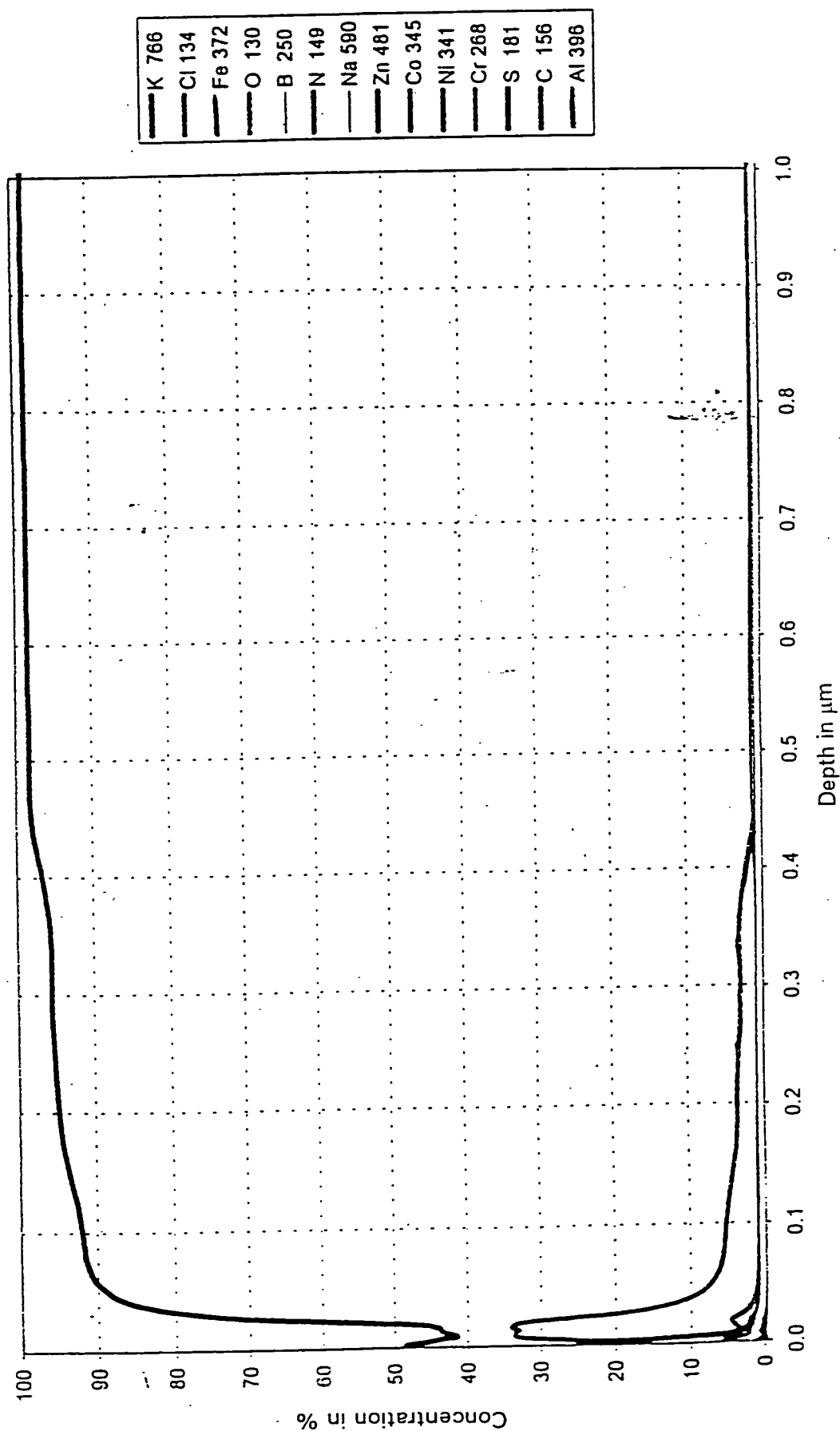


Diagram 1
TDEE 20-EBH060

Sample 1, Measurement Position B

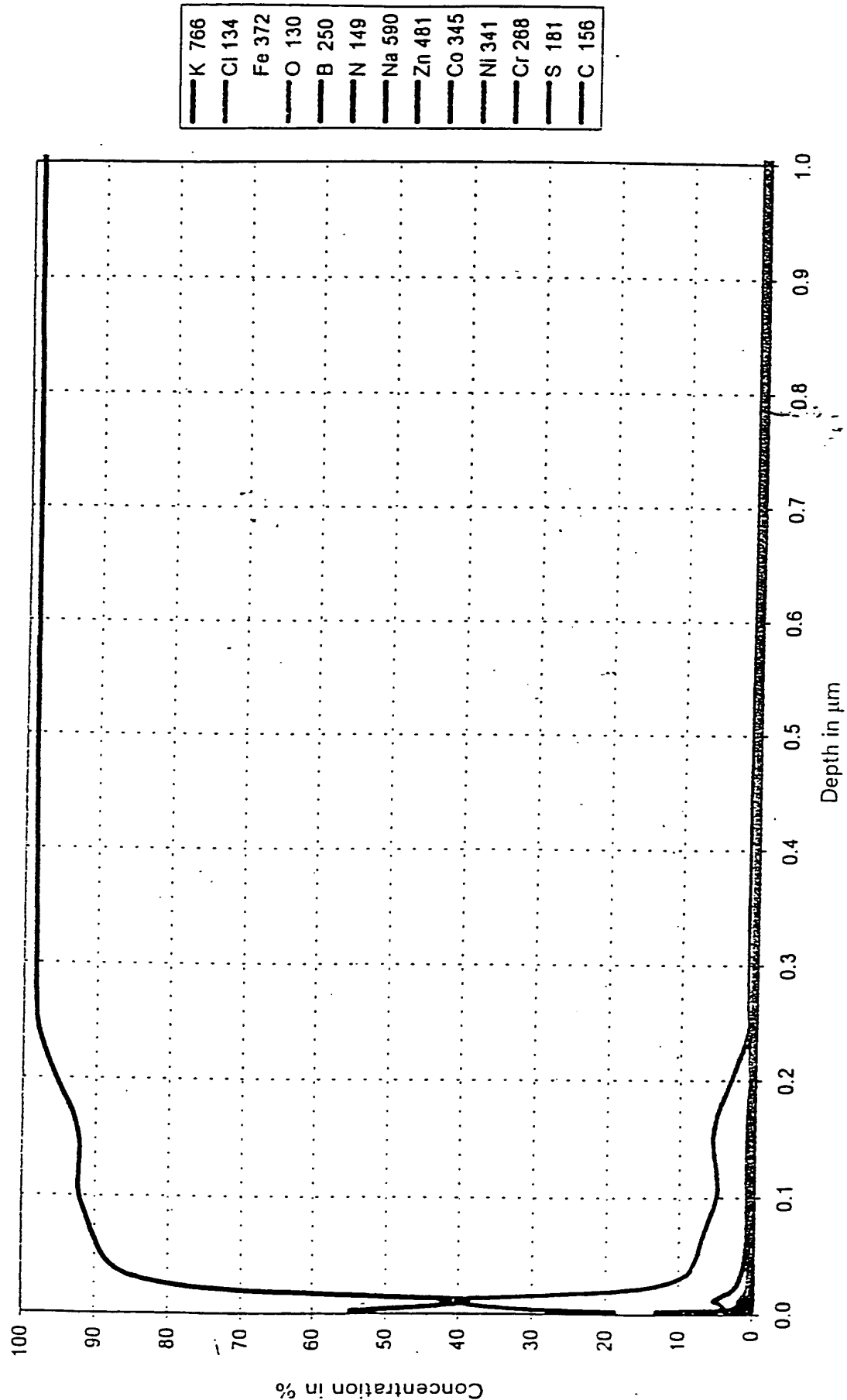


Diagram 2
Sample 1, Measurement Position B

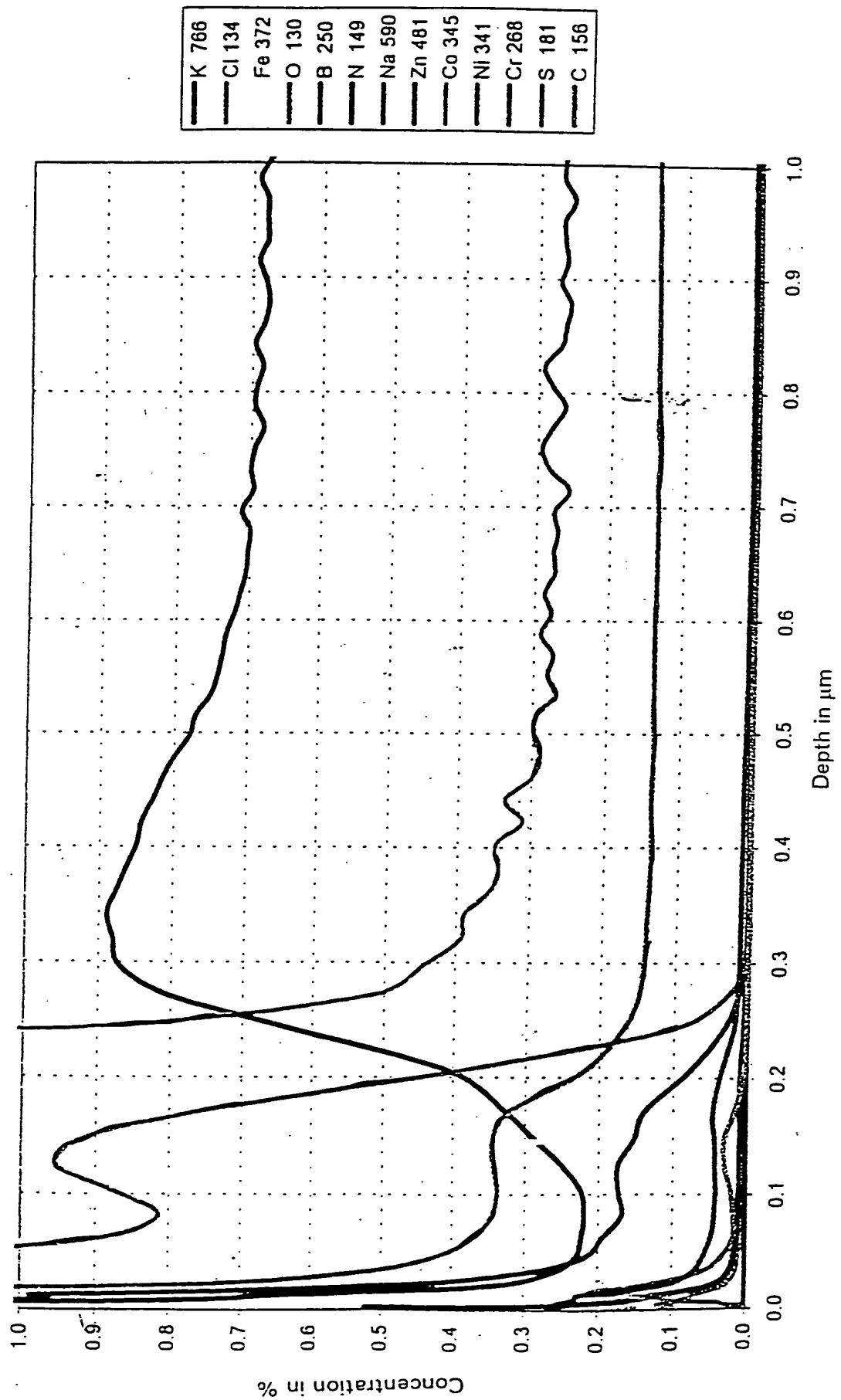
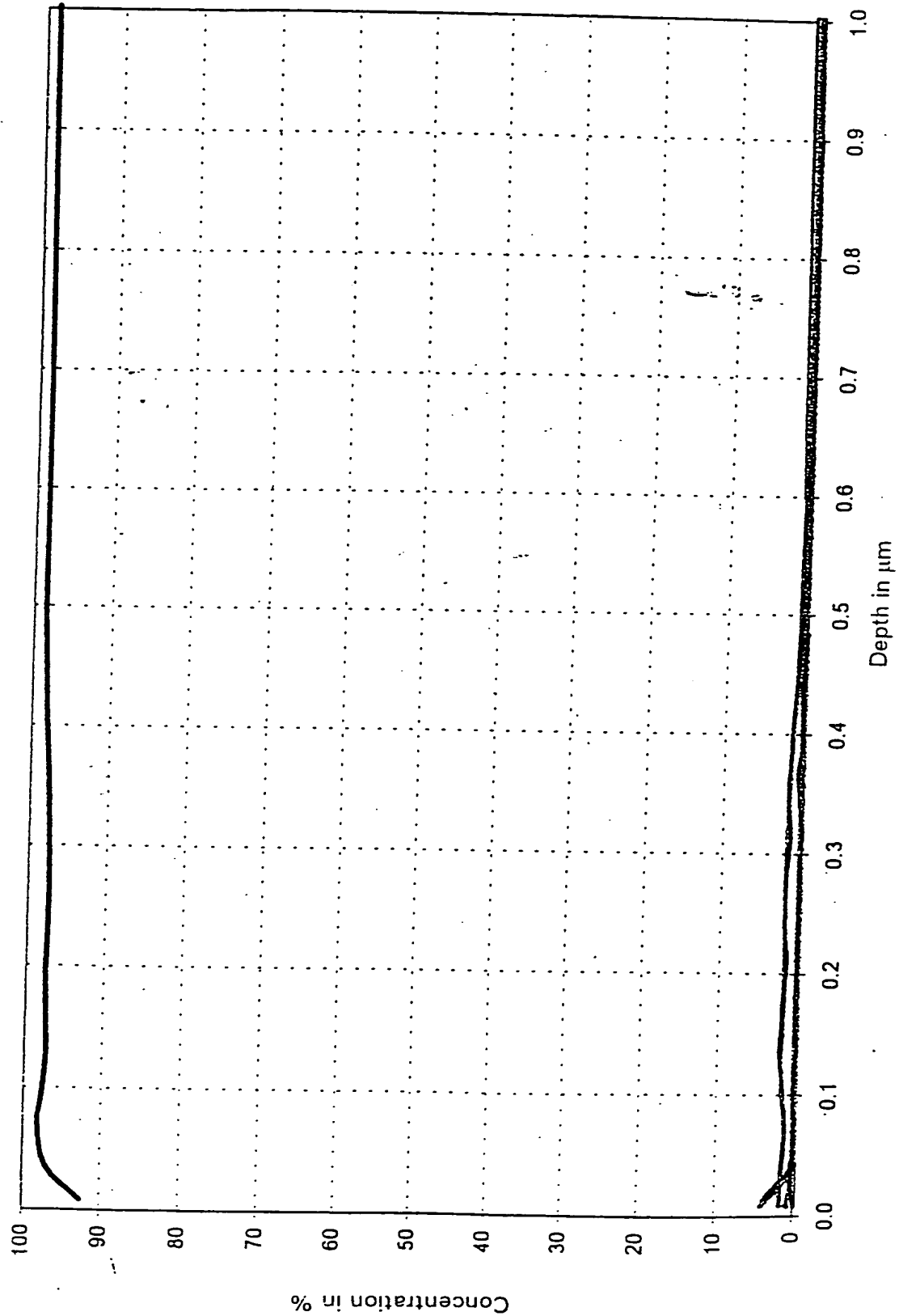


FIG. 8

T0E120" E064060

Sample 2, Measurement Position A

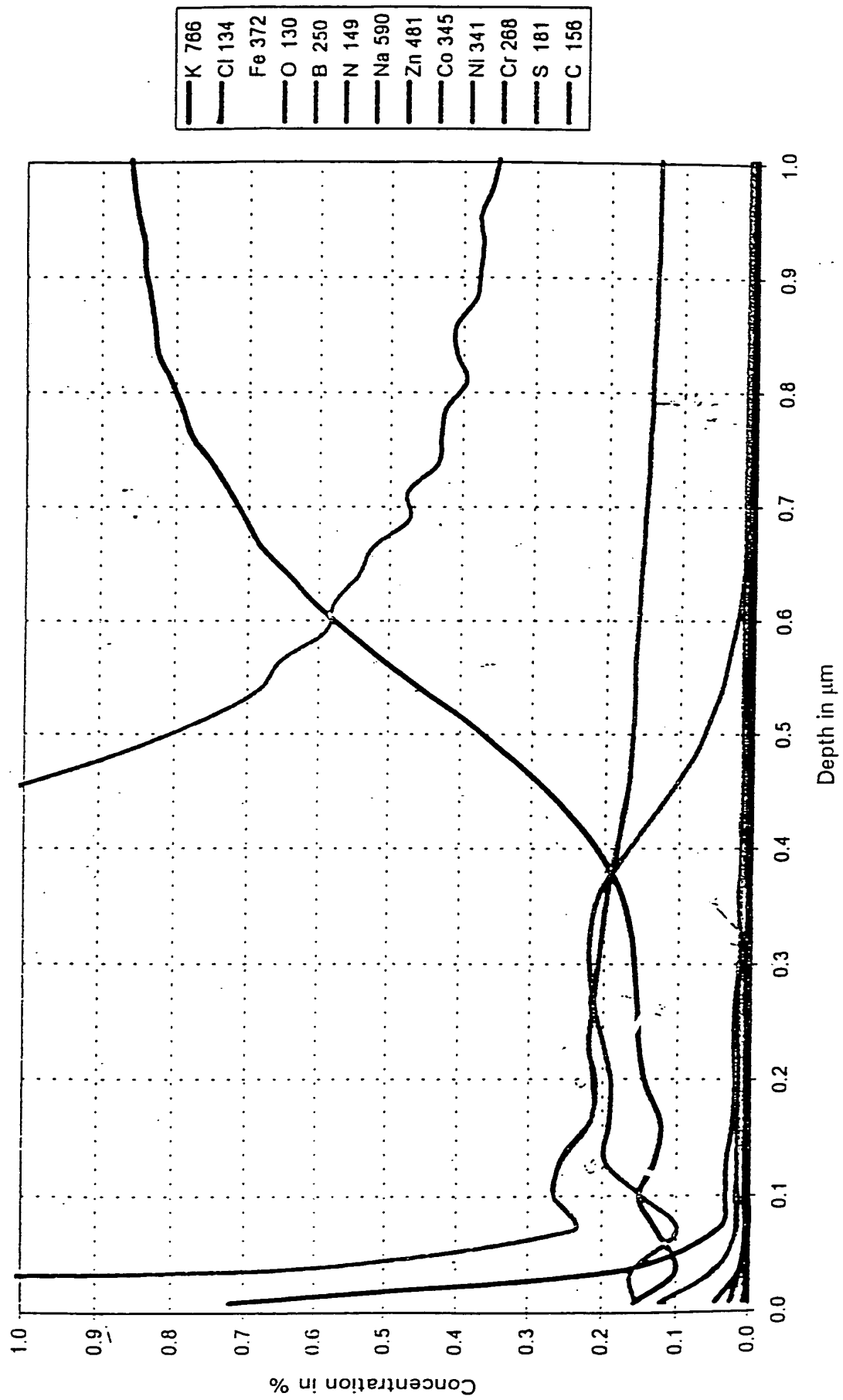


T0E120" E6640560

Diagram 2

Sample 2, Measurement Position A

FIG. 10



TEF20 E6670660

FIG. 11

Diagram 1

Sample 2, Measurement Position B

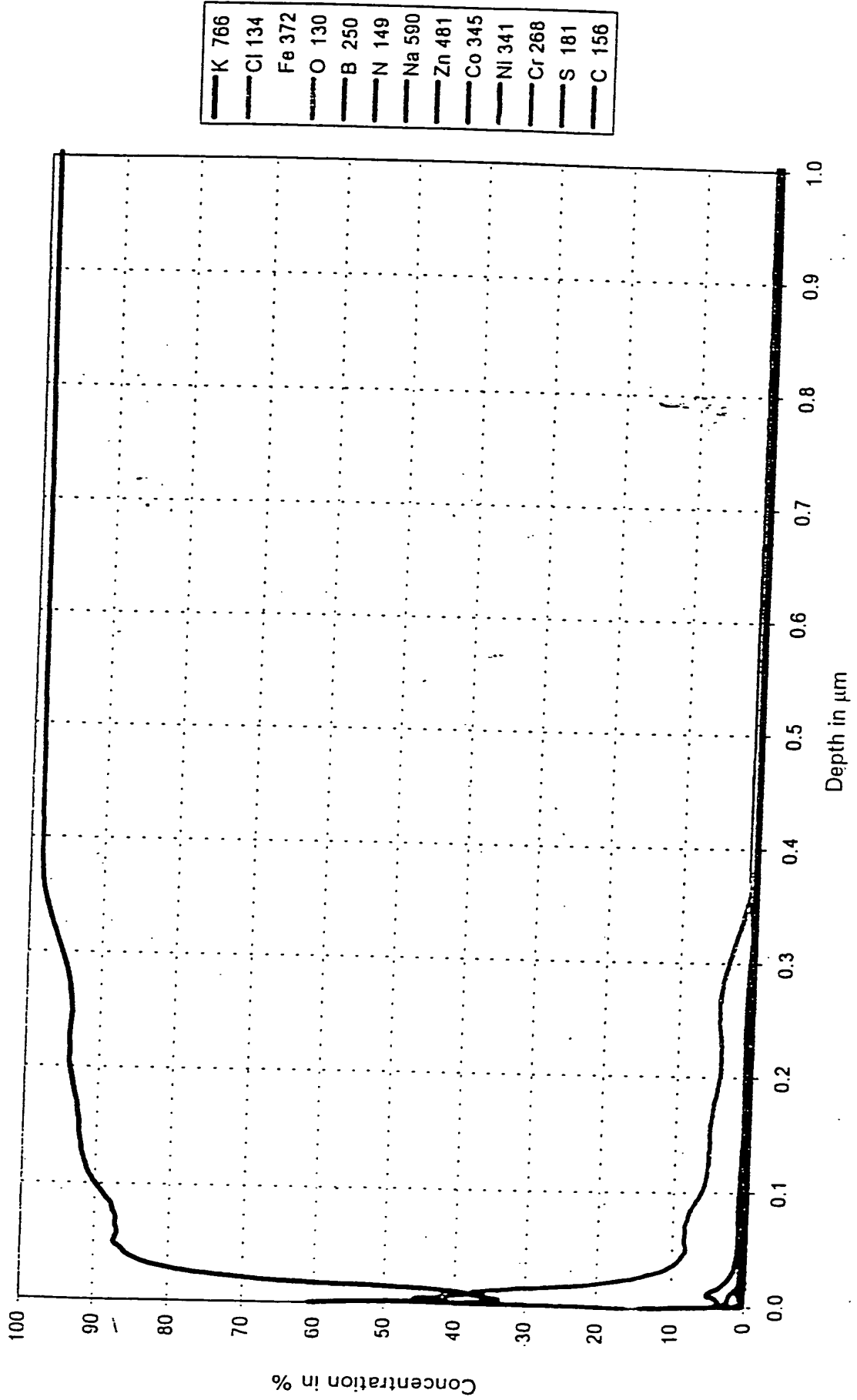
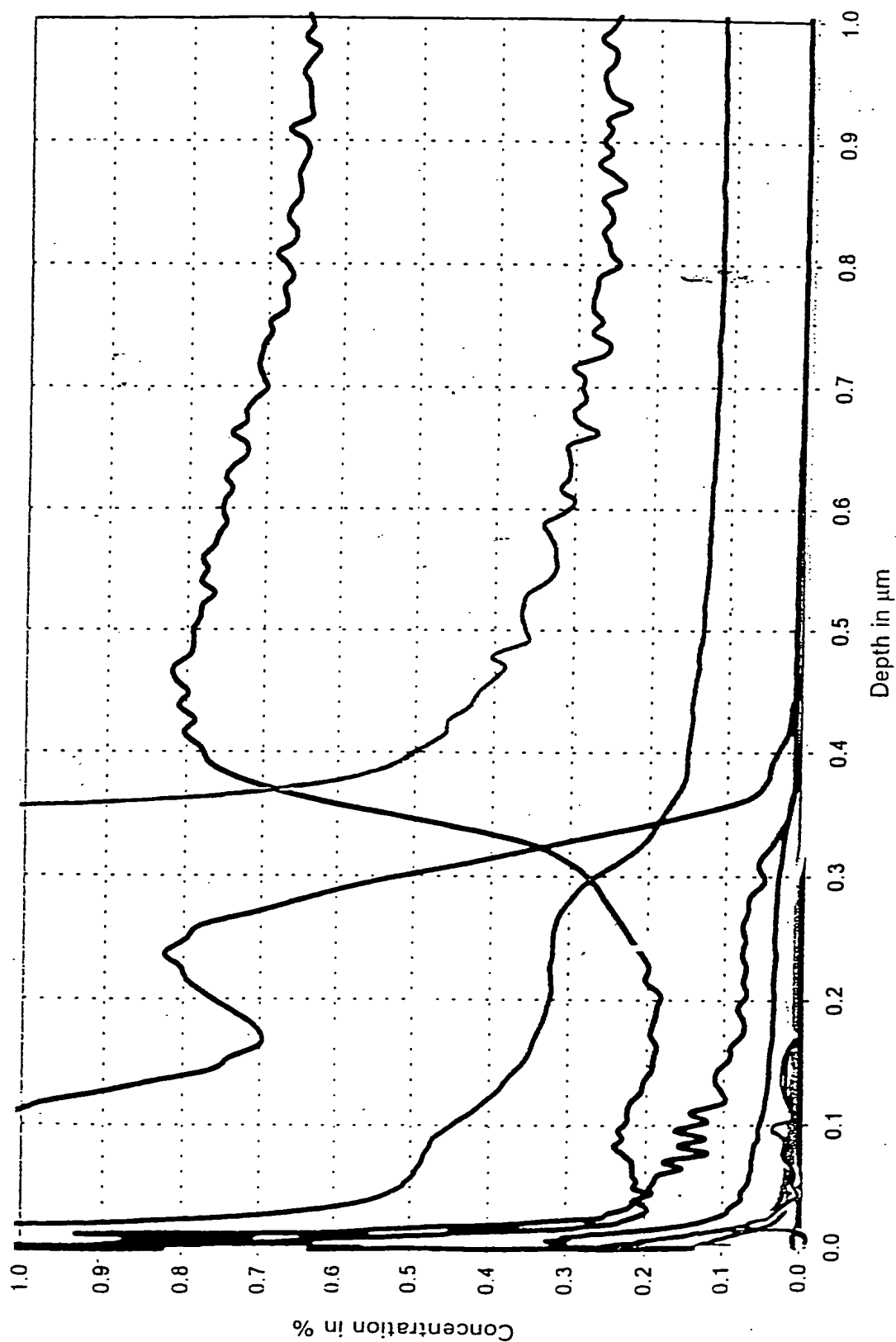


FIG. 12

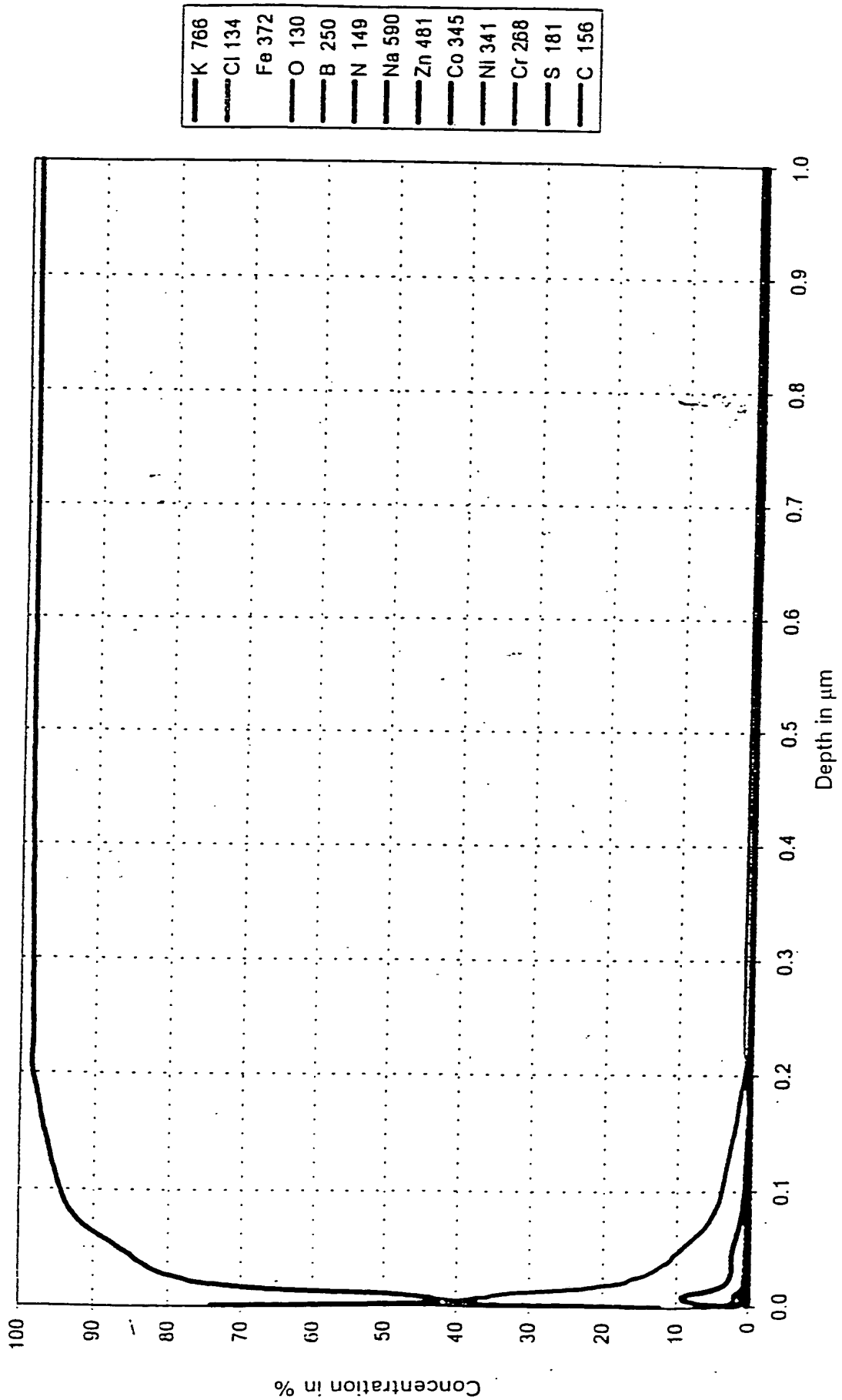
Diagram 2

Sample 2, Measurement Position B

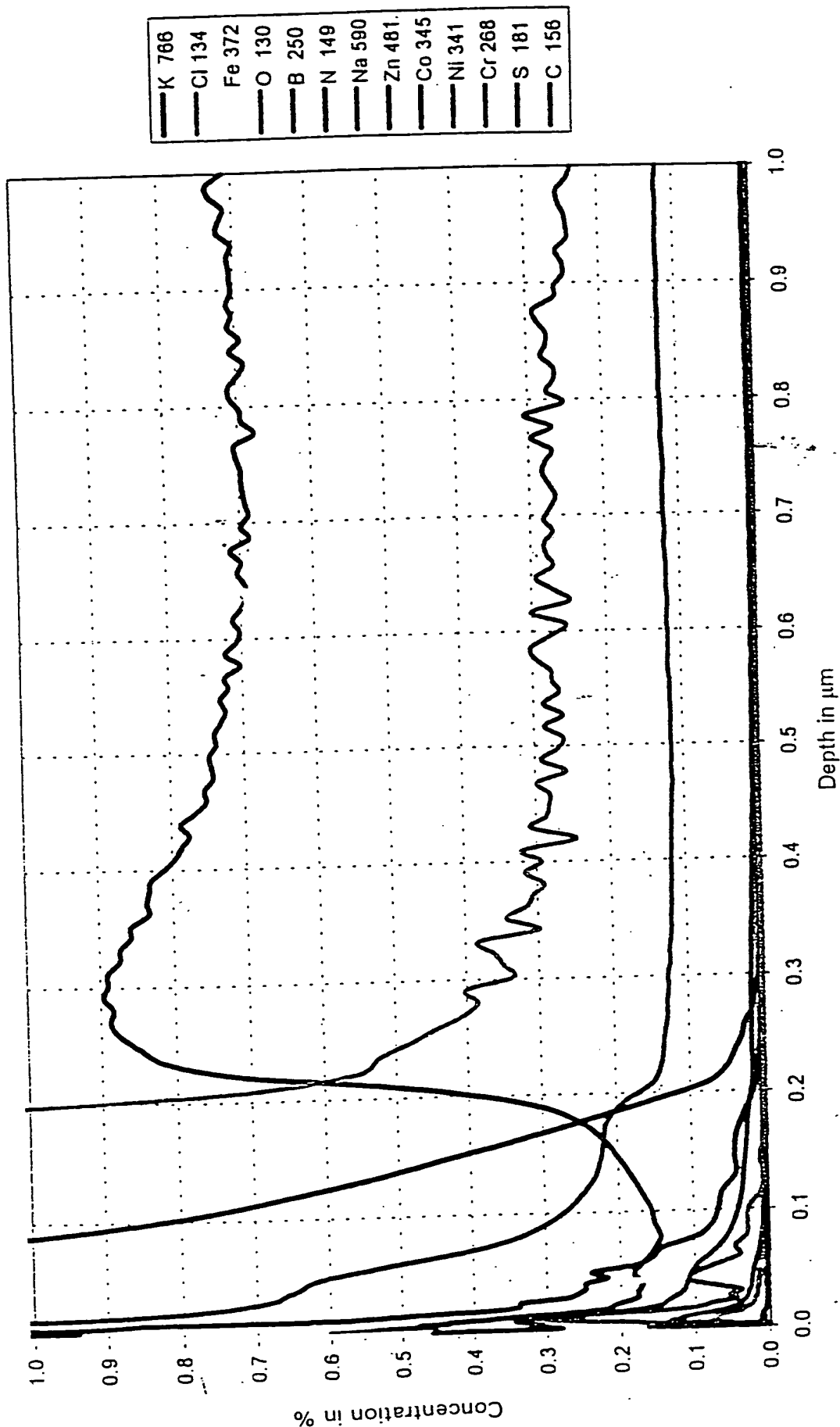


TOT 40" E66h0650
Diagram 1

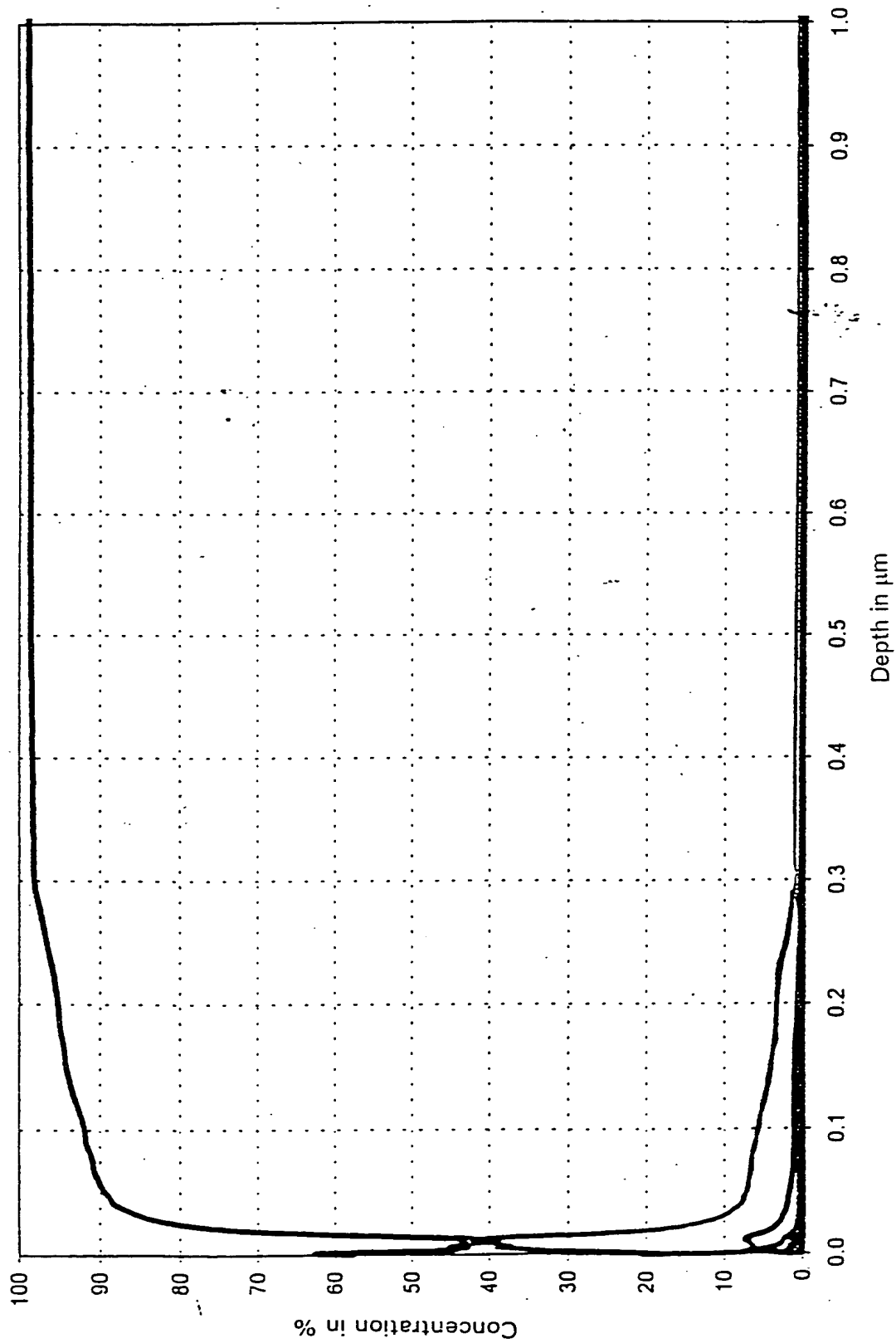
Sample 3, Measurement Position A



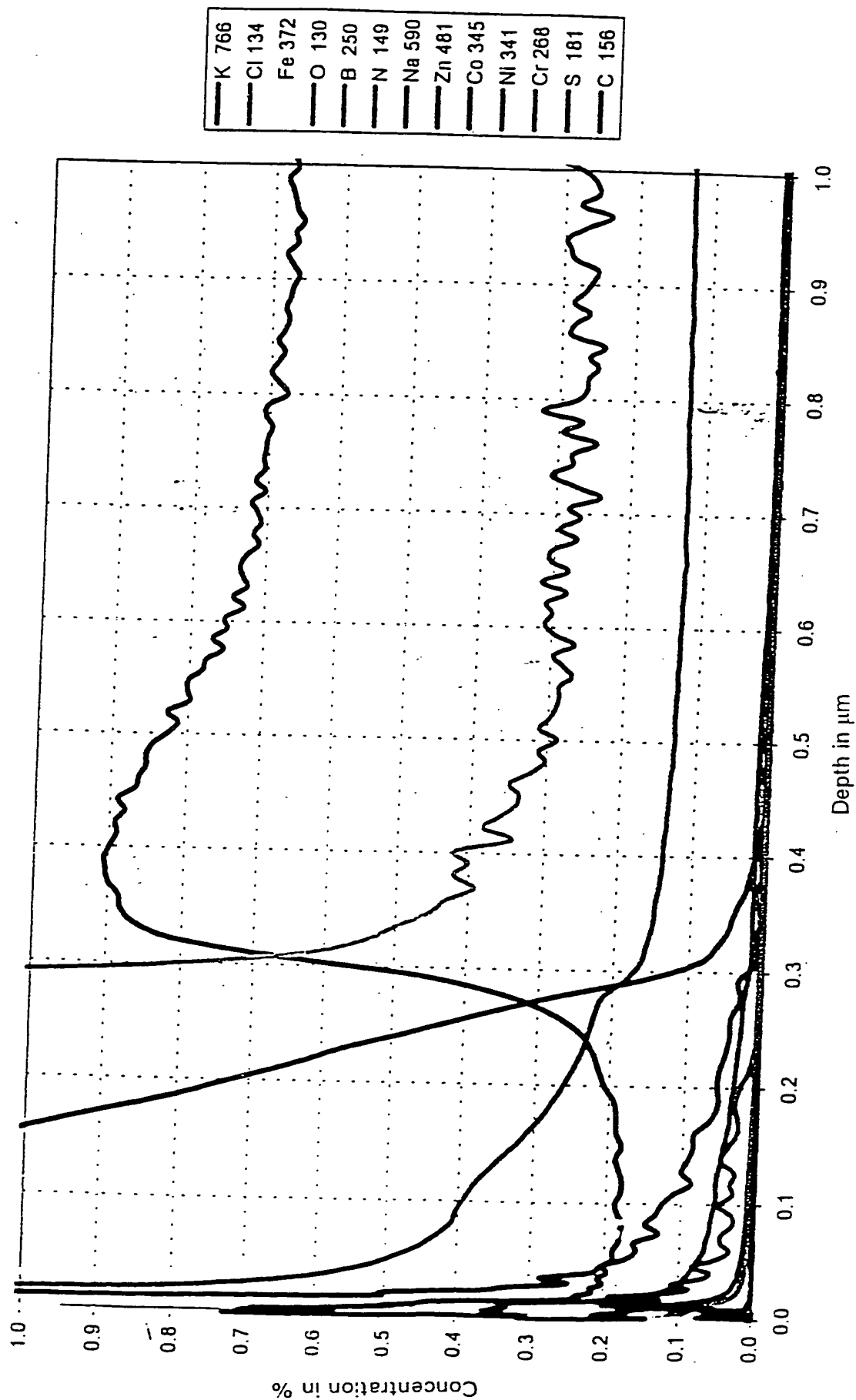
Sample 3, Measurement Position A



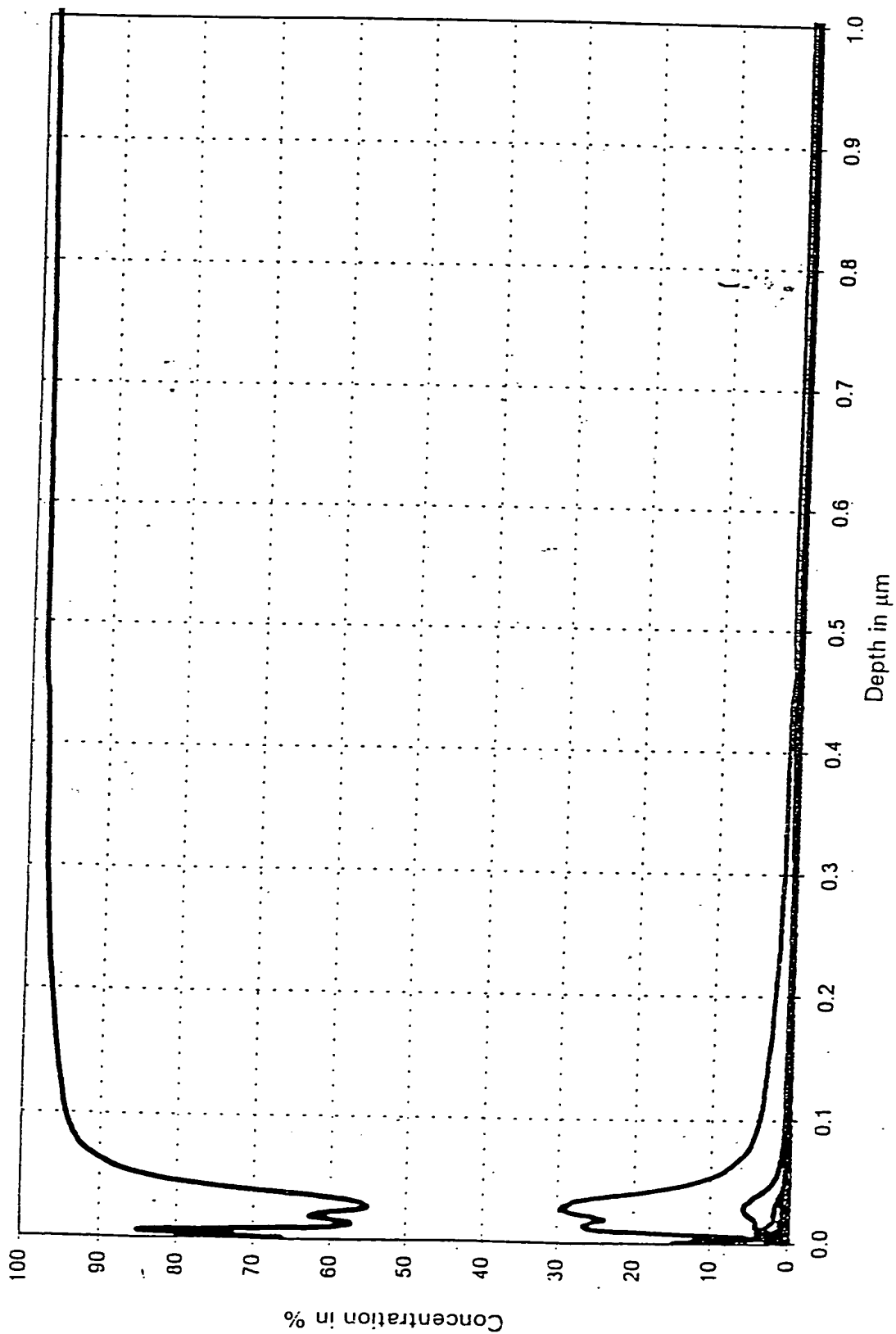
Sample 4, Measurement Position A



Sample 4, Measurement Position A



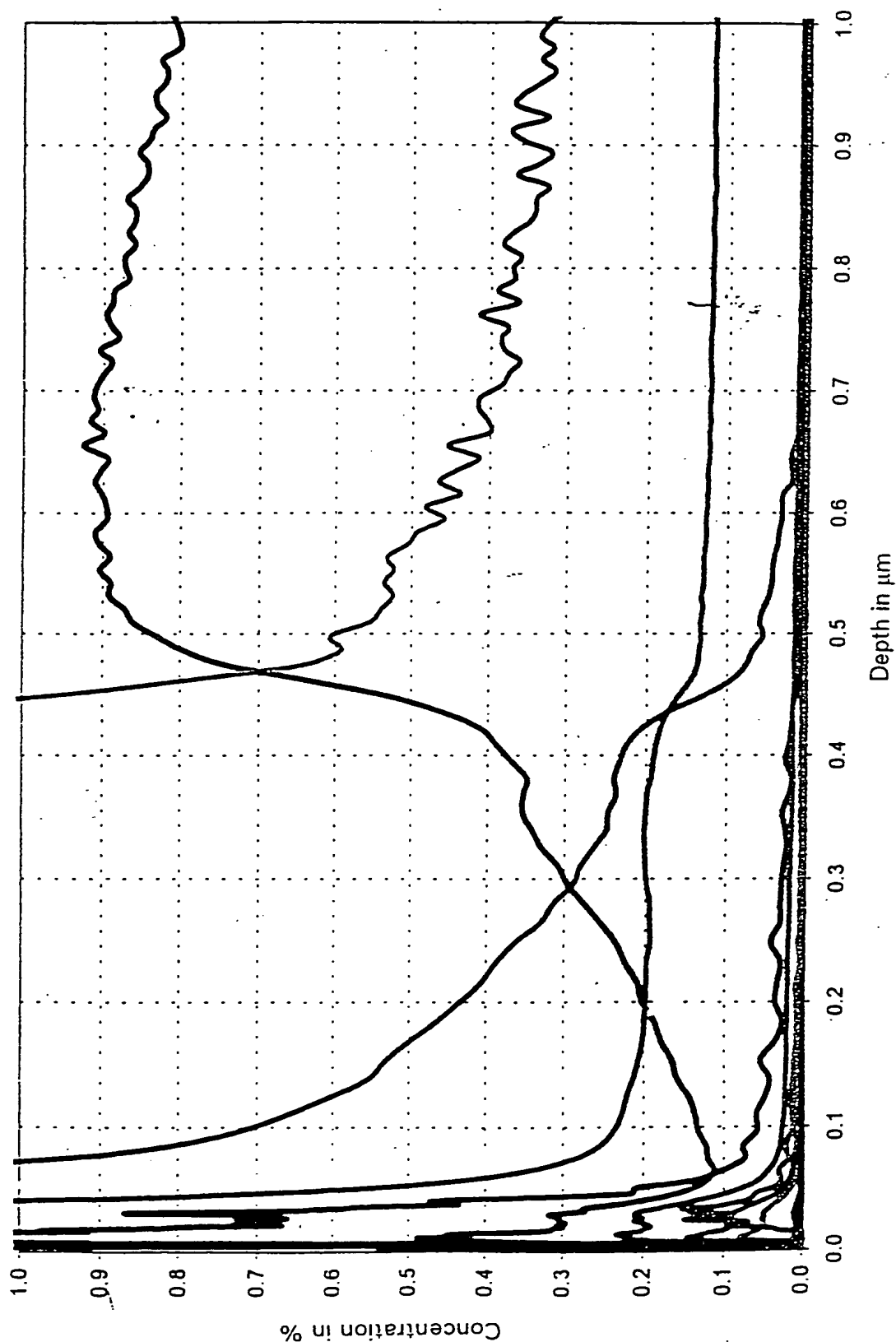
—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 156



Sample 5, Measurement Position A

Diagram 1

—	K 768
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 156

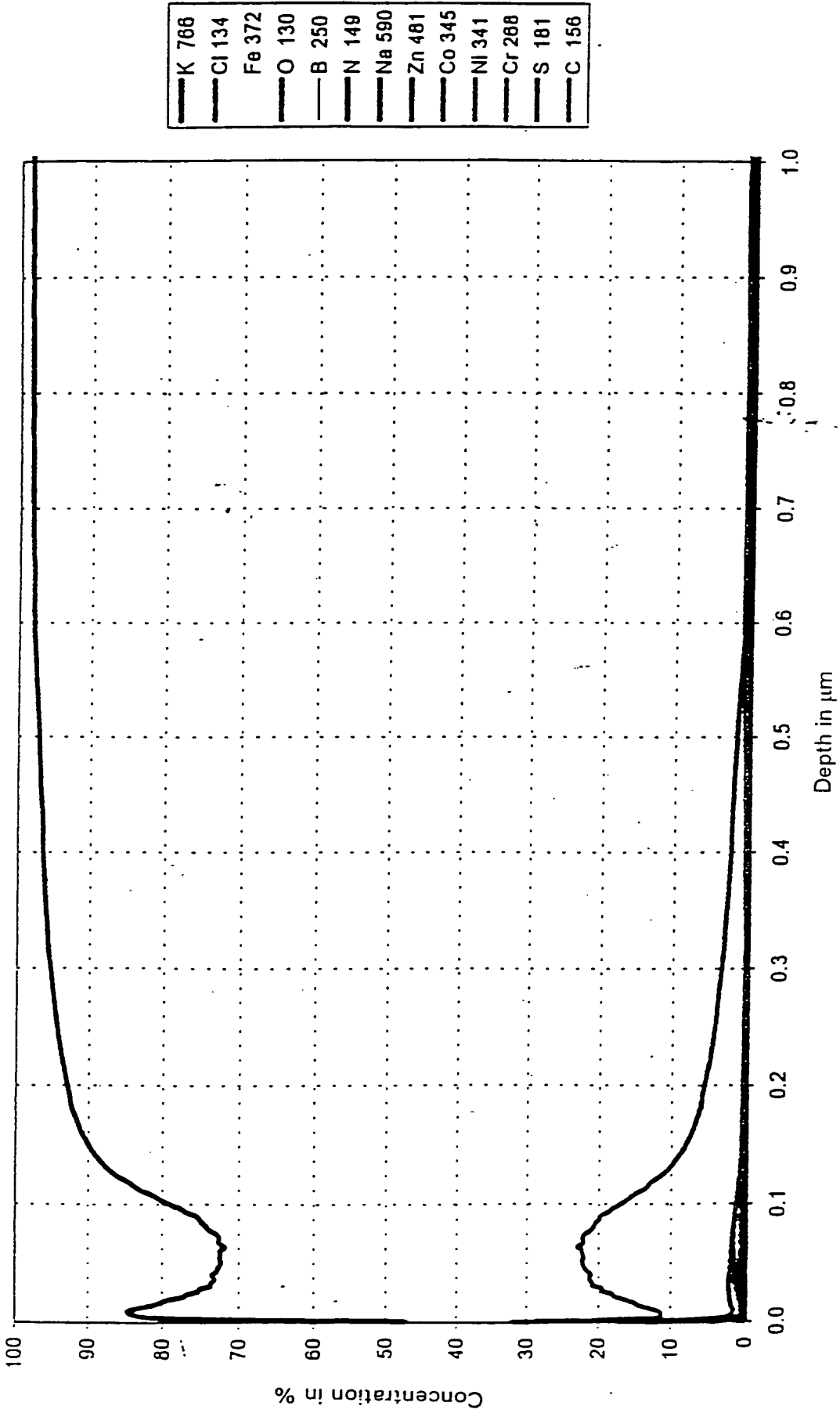


Sample 5, Measurement Position A

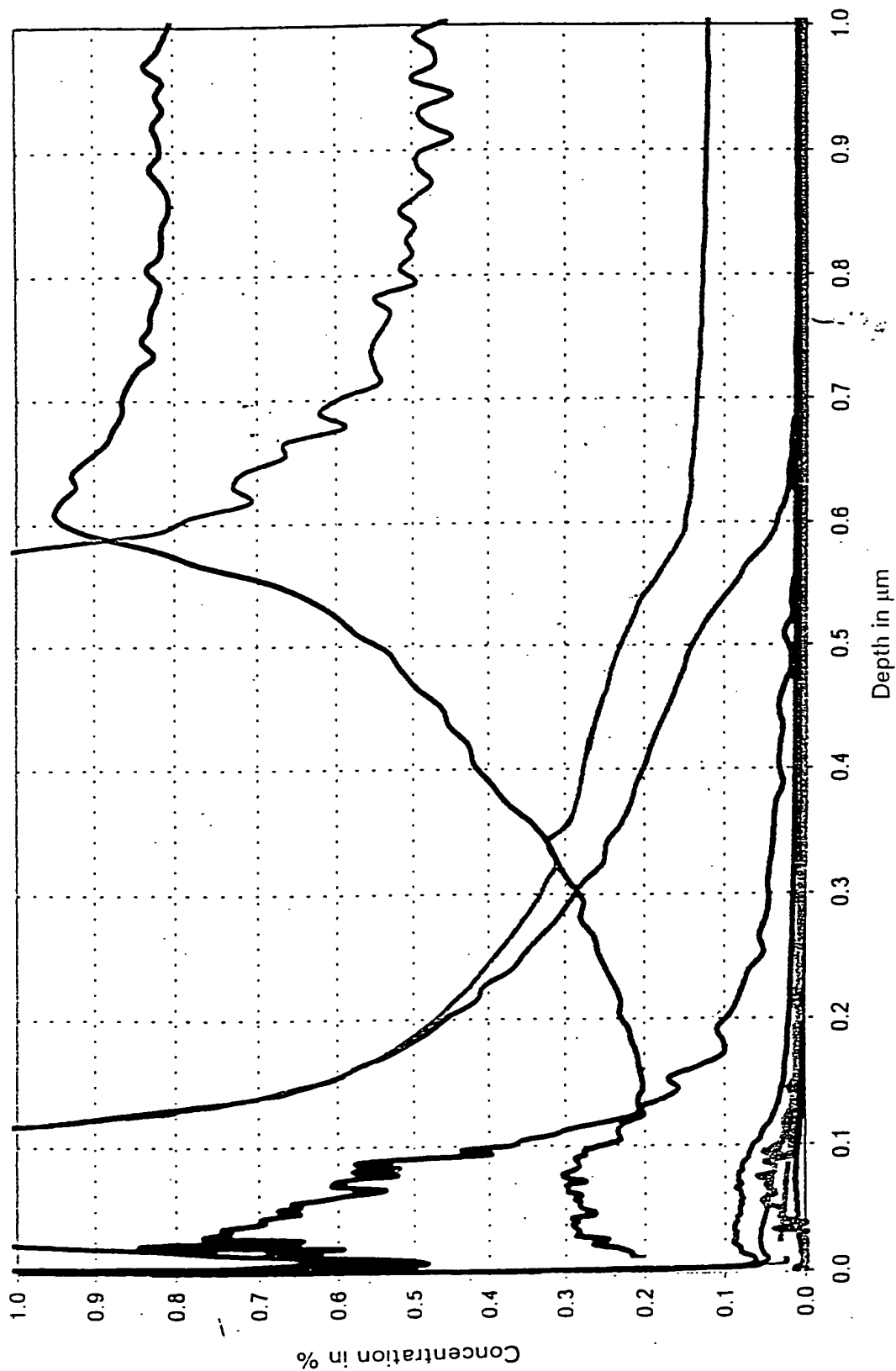
Diagram 2

Diagram 1
F0E120 E6670660

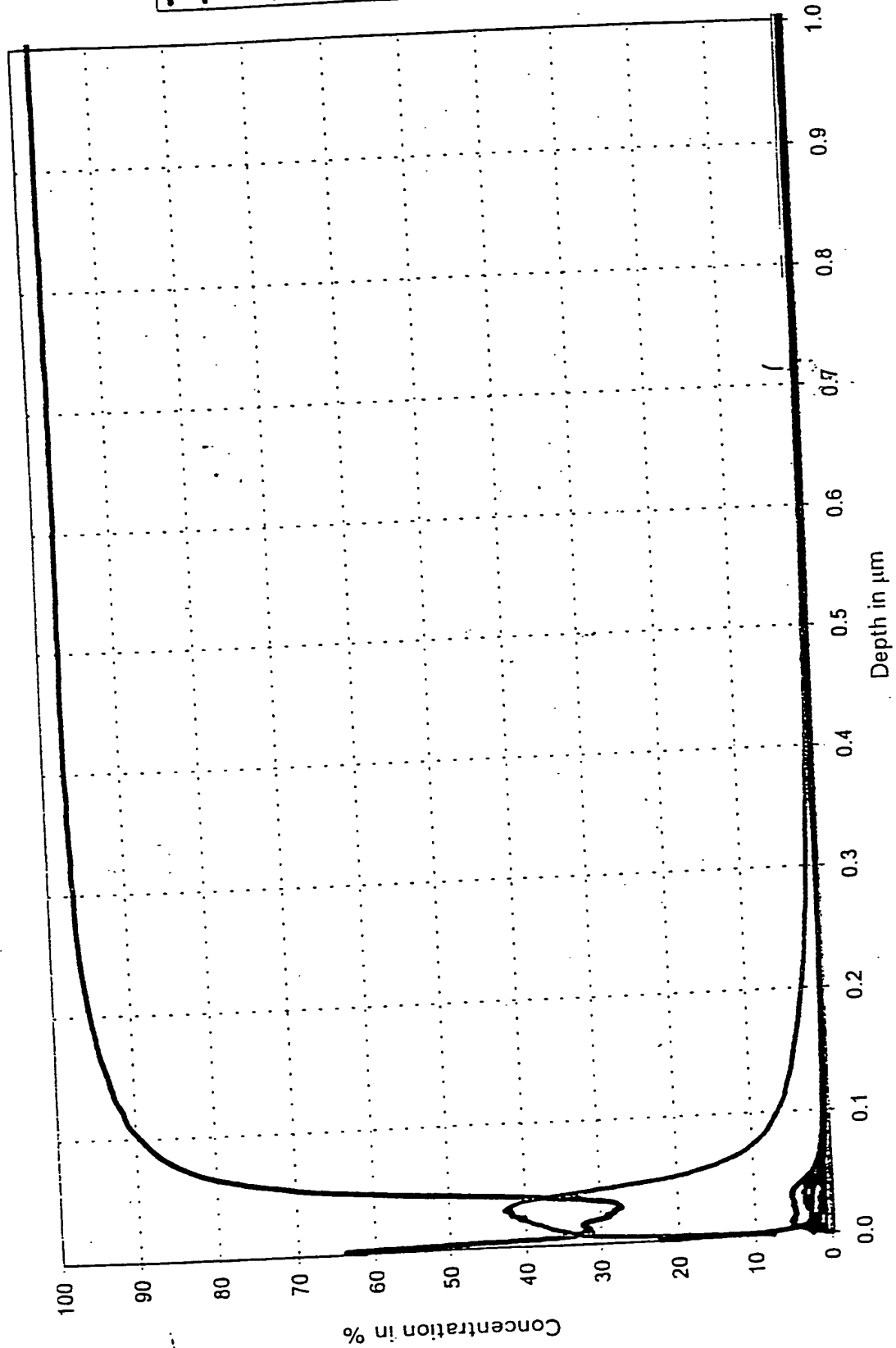
Sample 6, Measurement Position A



Sample 6, Measurement Position A



Sample 6, Measurement Position B



— K 768
— Cl 134
— Fe 372
— O 130
— B 250
— N 149
— Na 590
— Zn 461
— Co 345
— Ni 341
— Cr 288
— S 181
— C 156

Sample 6, Measurement Position B

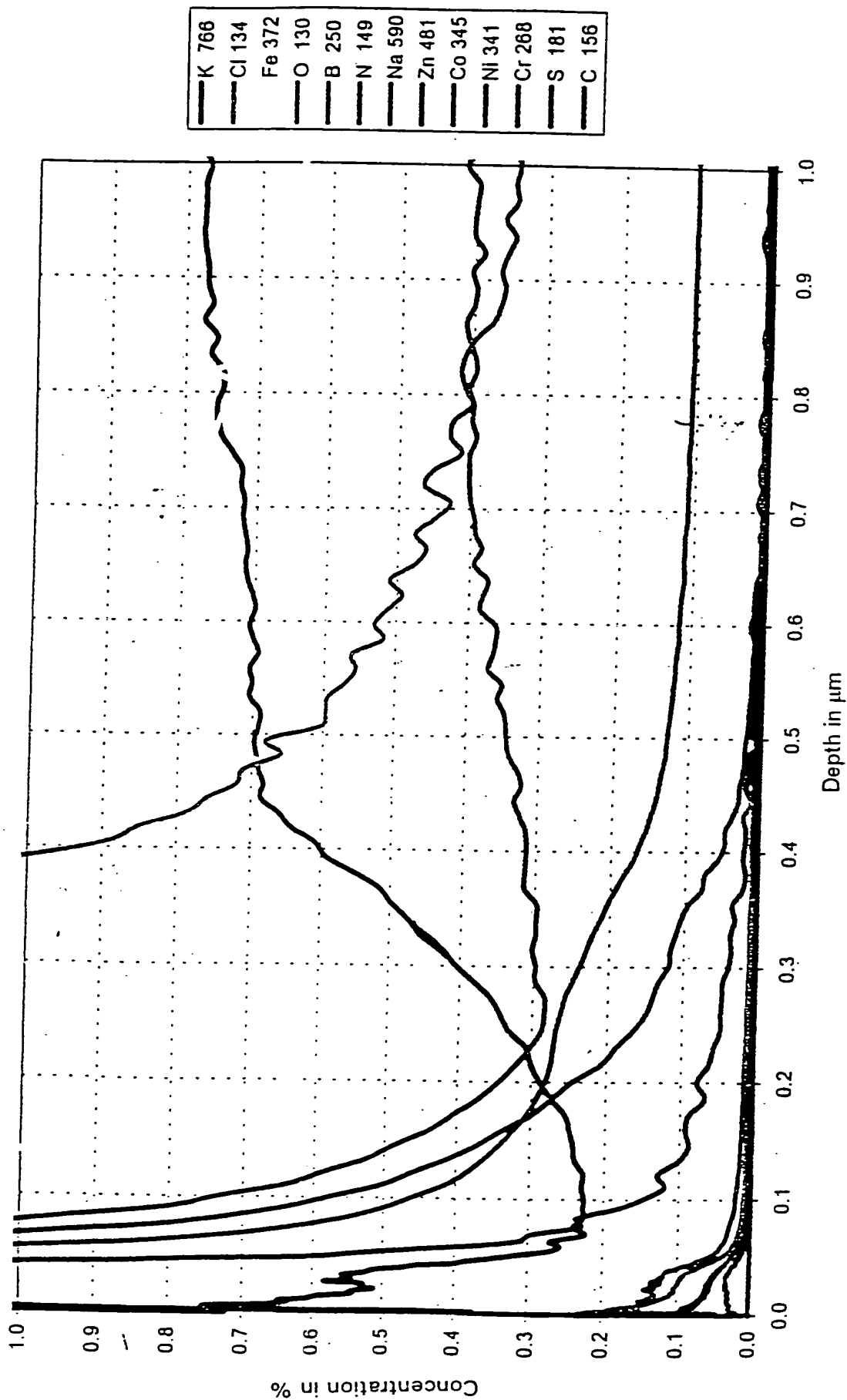
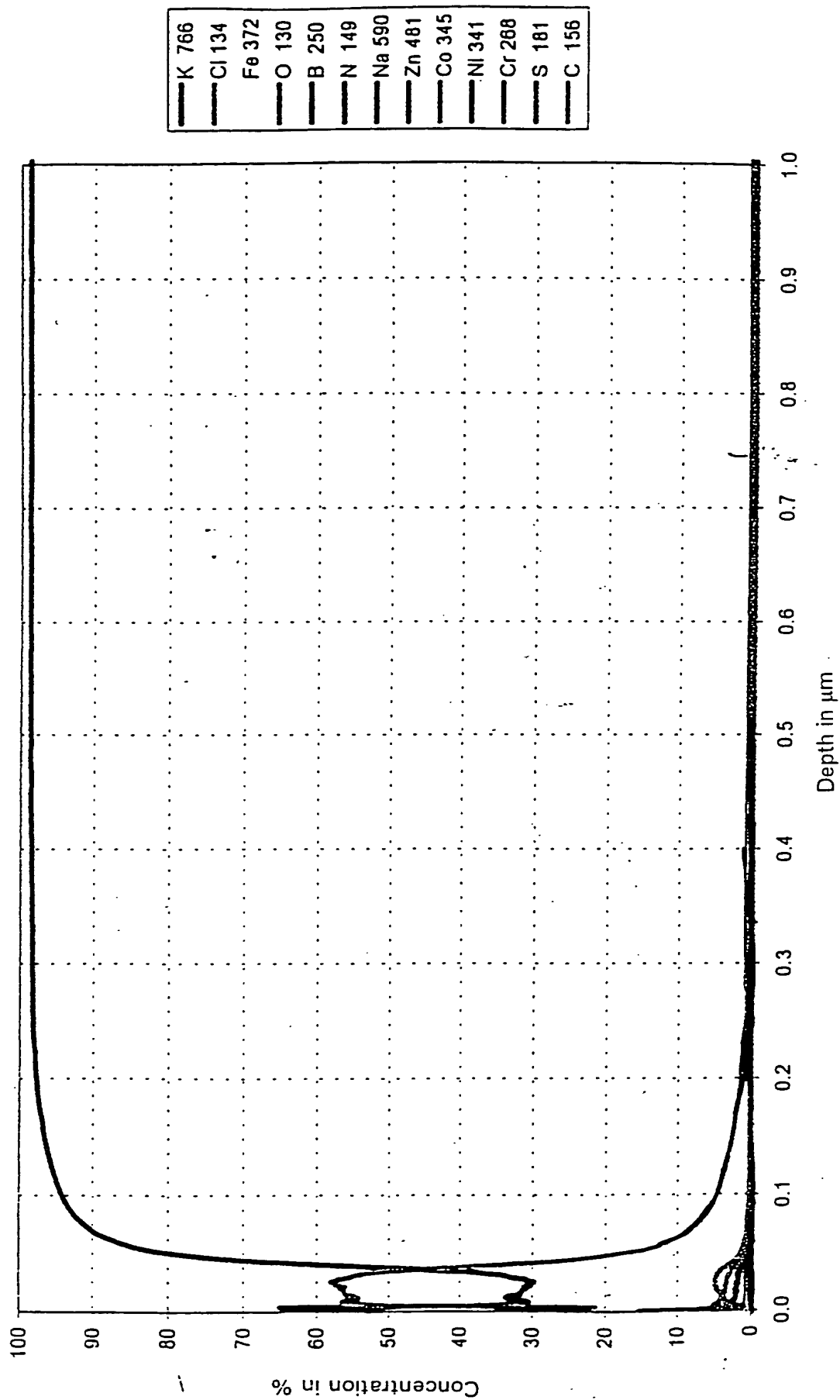
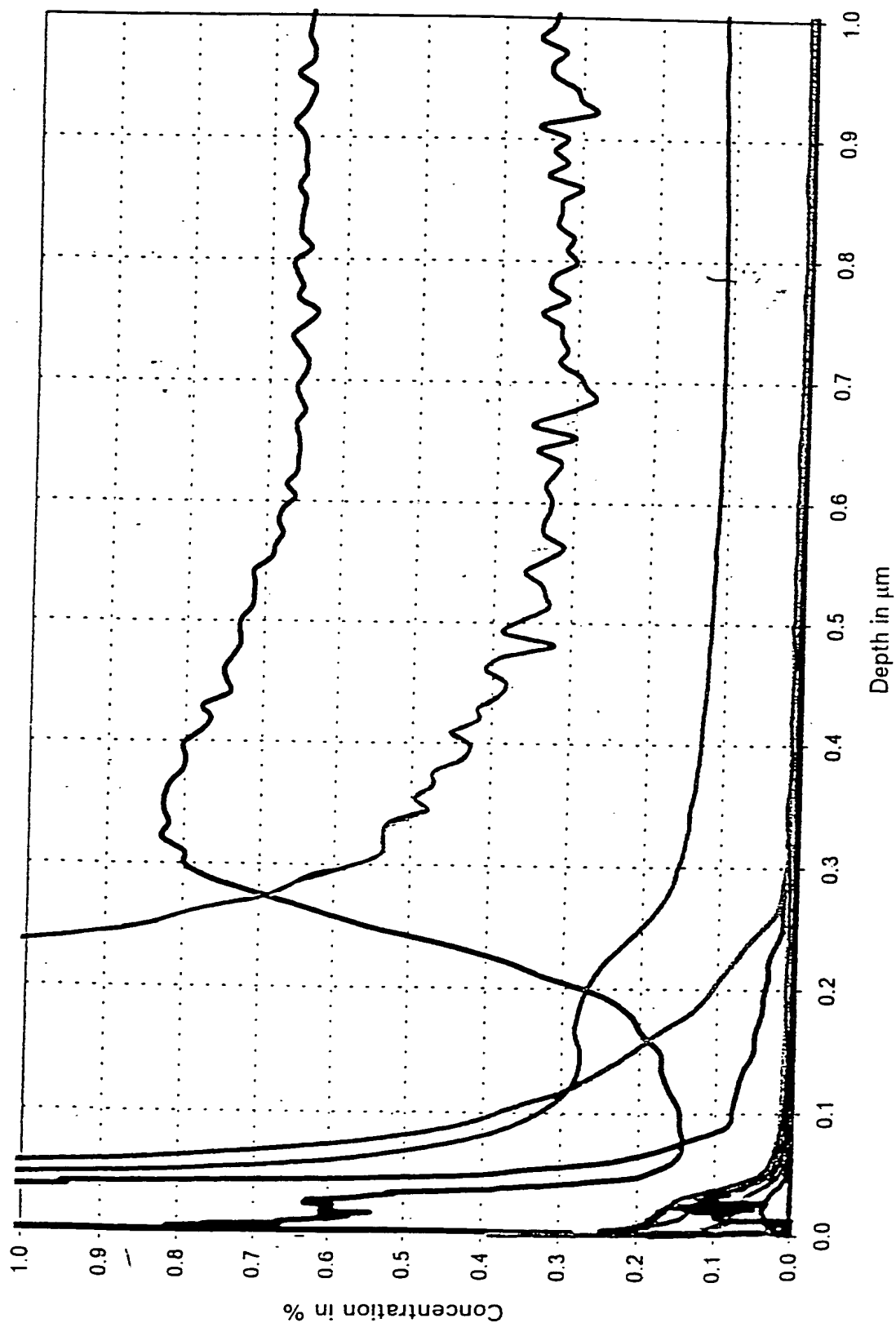
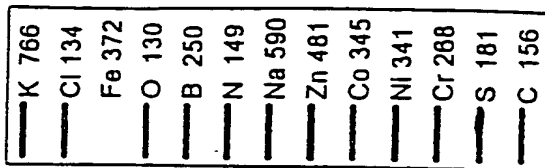


FIG. 23

Sample 6, Measurement Position C





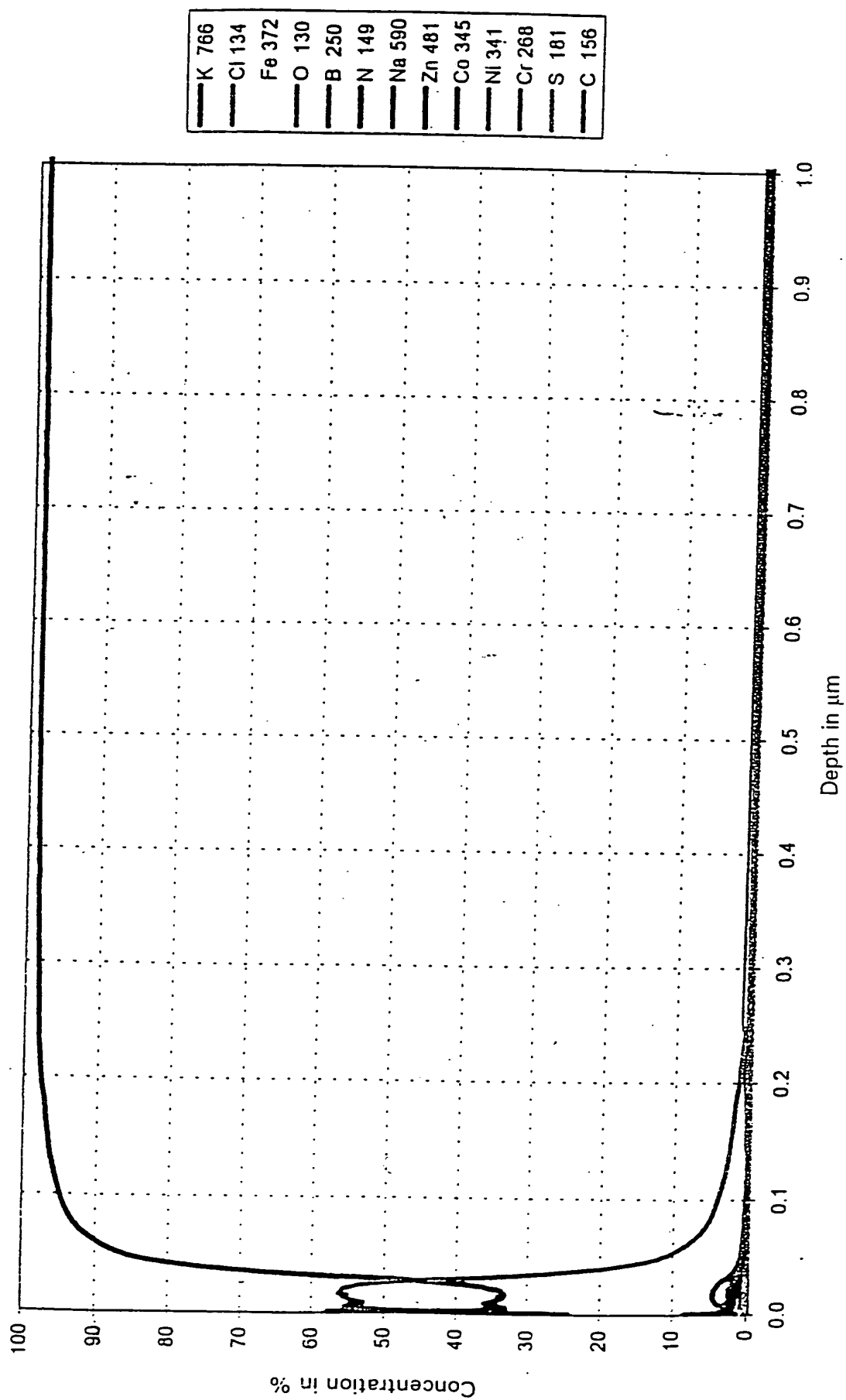
Sample 6, Measurement Position C

Diagram 2

FIG. 25

Diagram 1

Sample 6, Measurement Position D



—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 288
—	S 181
—	C 158

Sample 6, Measurement Position D

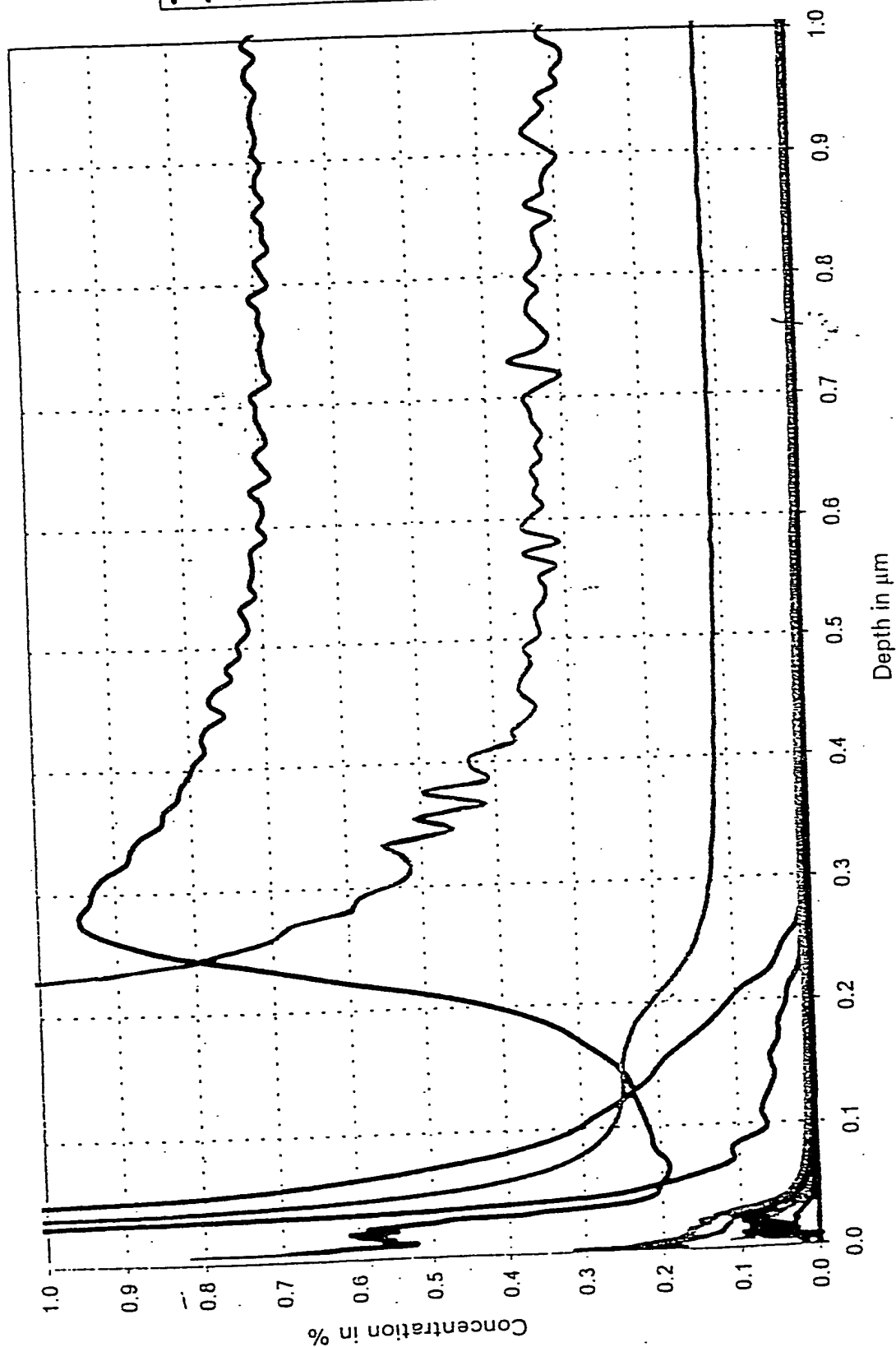


FIG. 26

FOET 20" E6640500

Diagram 1

Sample 7, Measurement Position A

FIG. 27

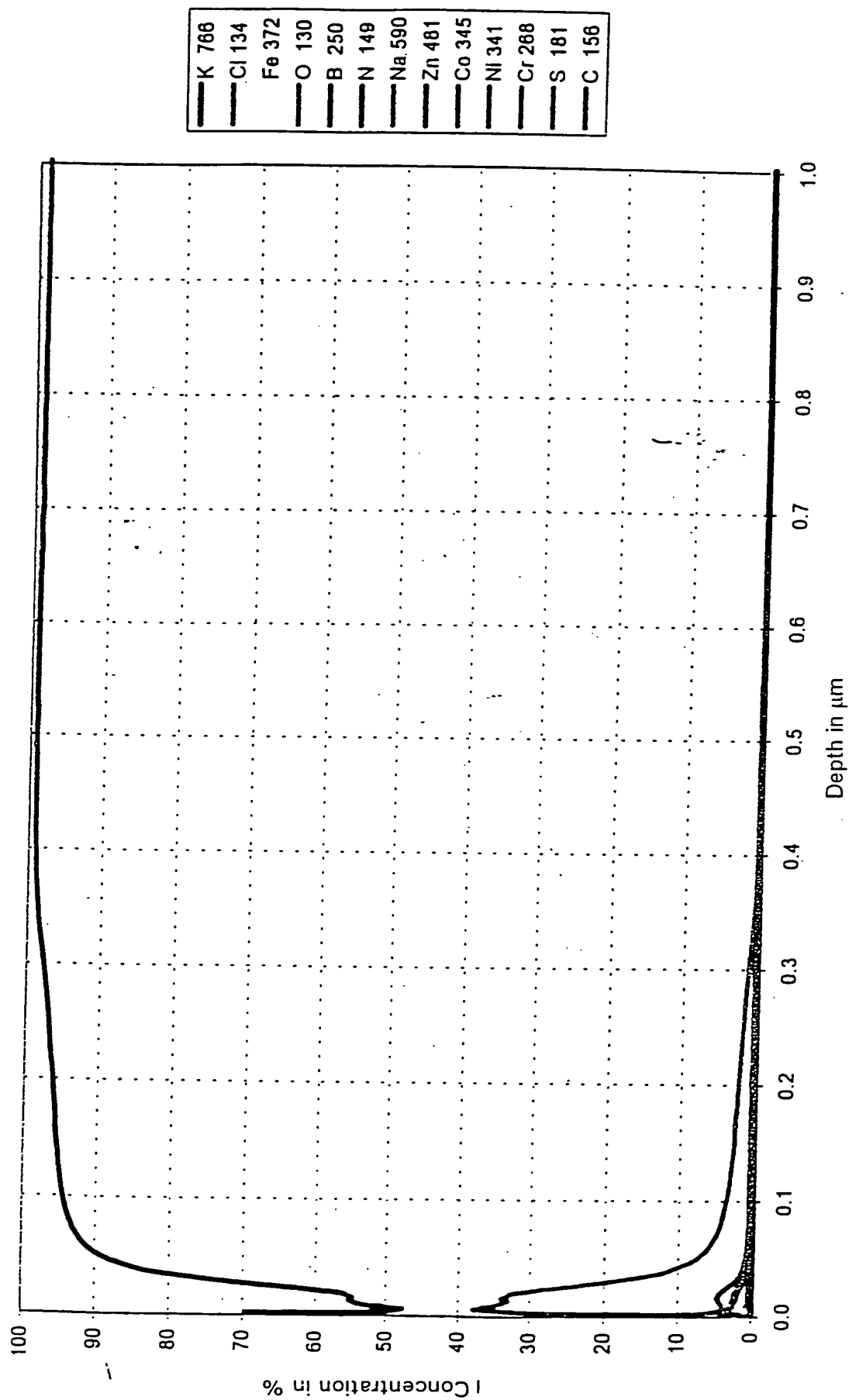


FIG. 28

Sample 7, Measurement Position A

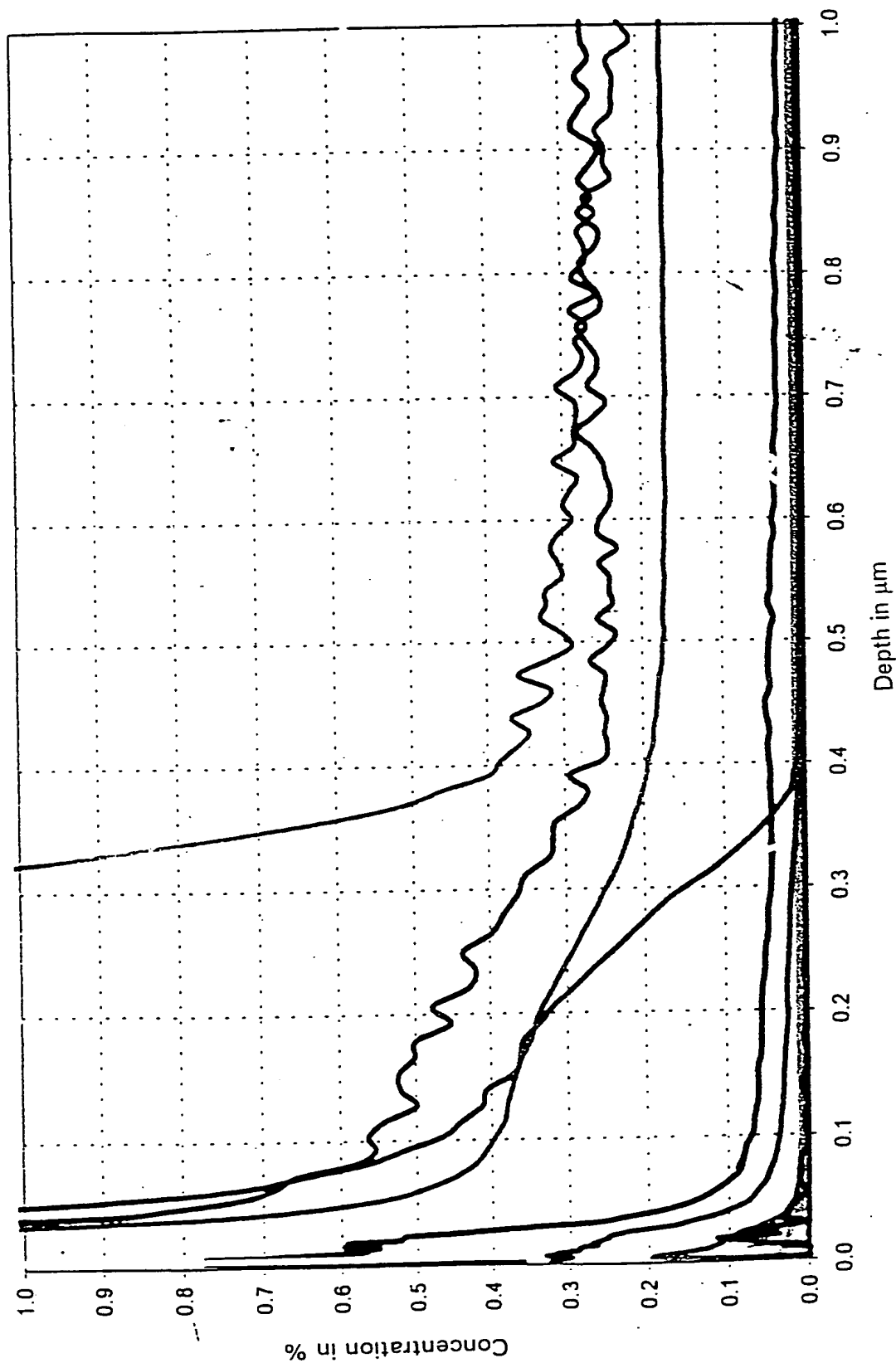
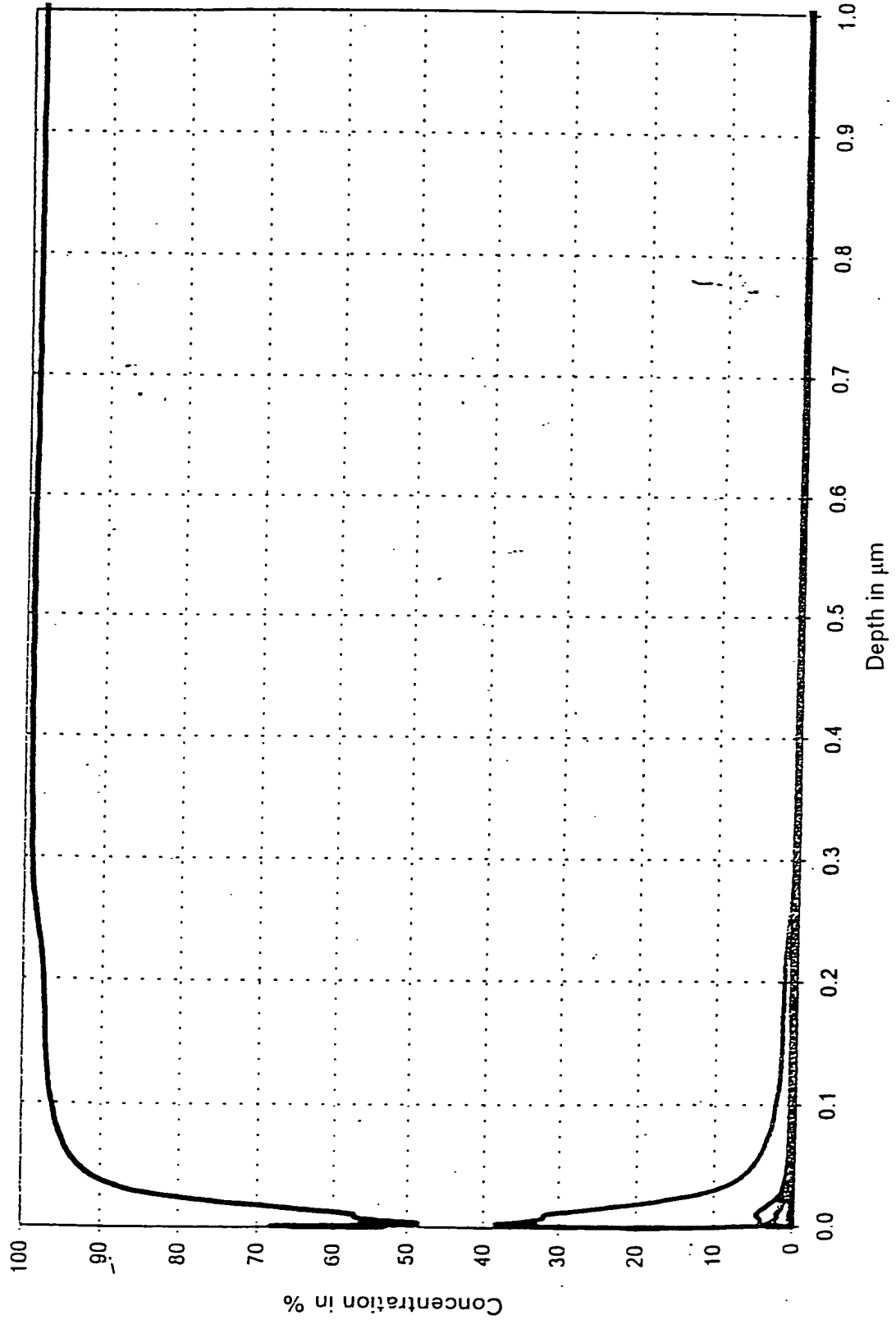
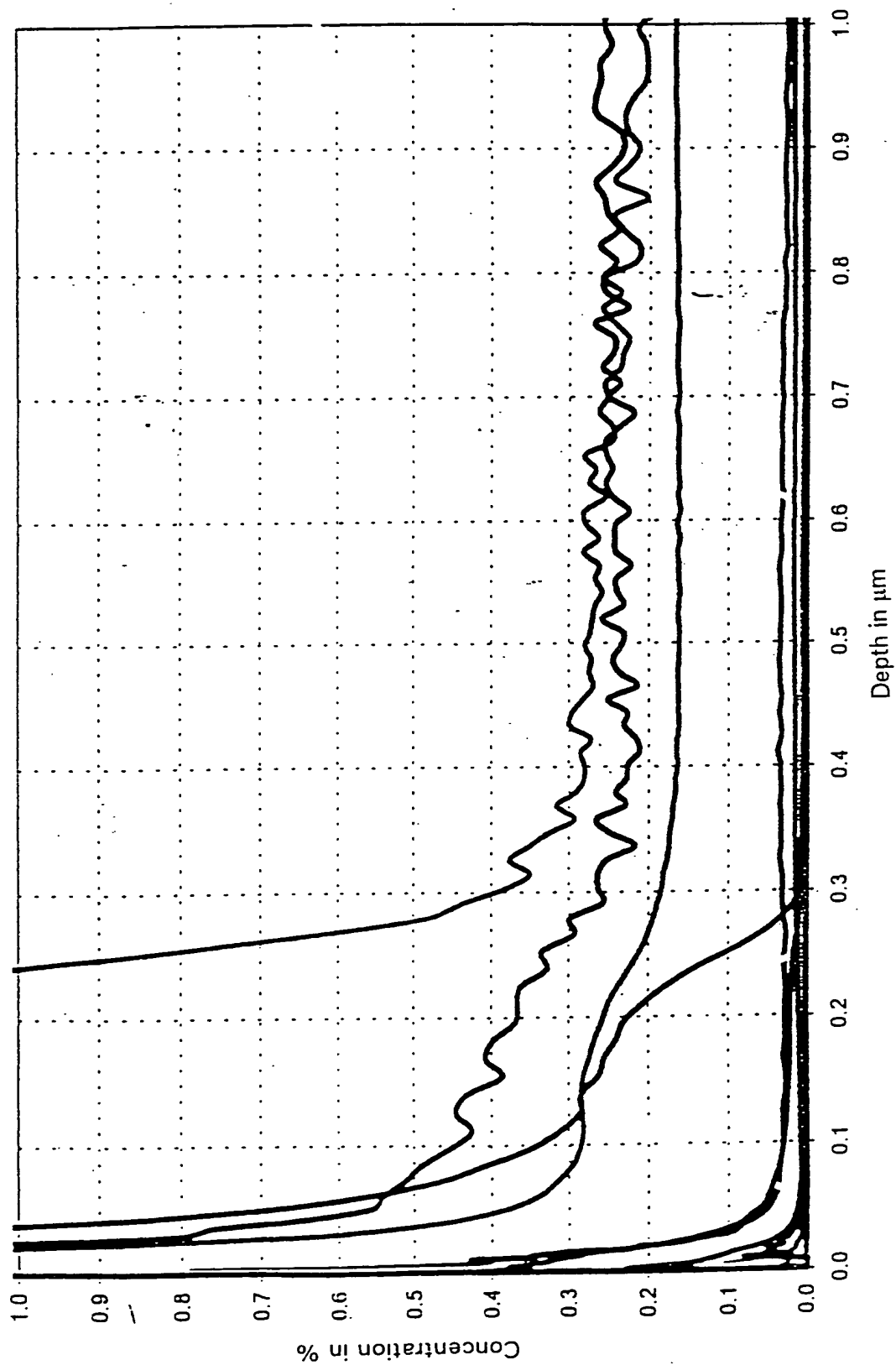


Diagram 1

Sample 7, Measurement Position B



—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 158



Sample 7, Measurement Position B

Sample 8, Measurement Position A

Diagram 1

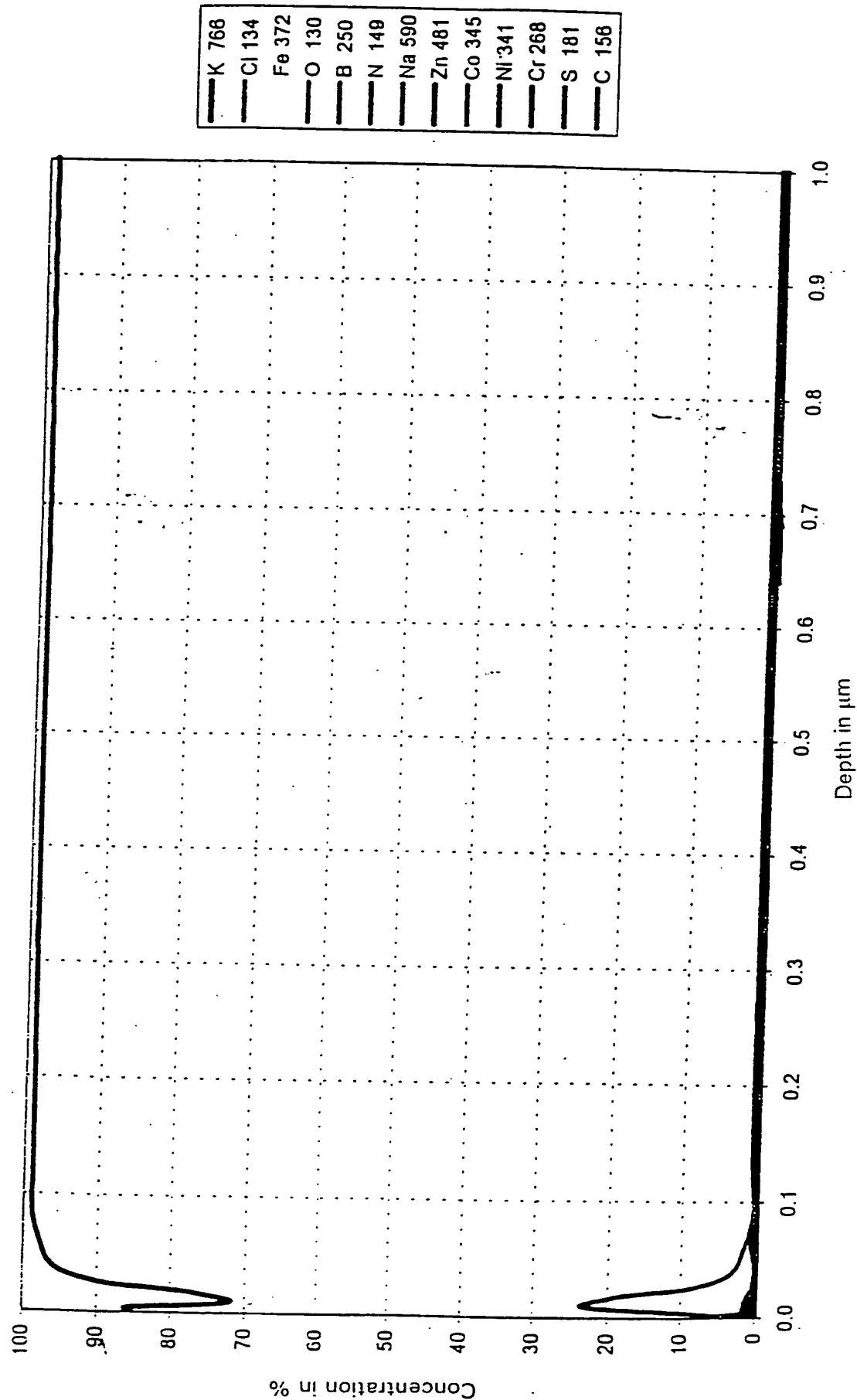
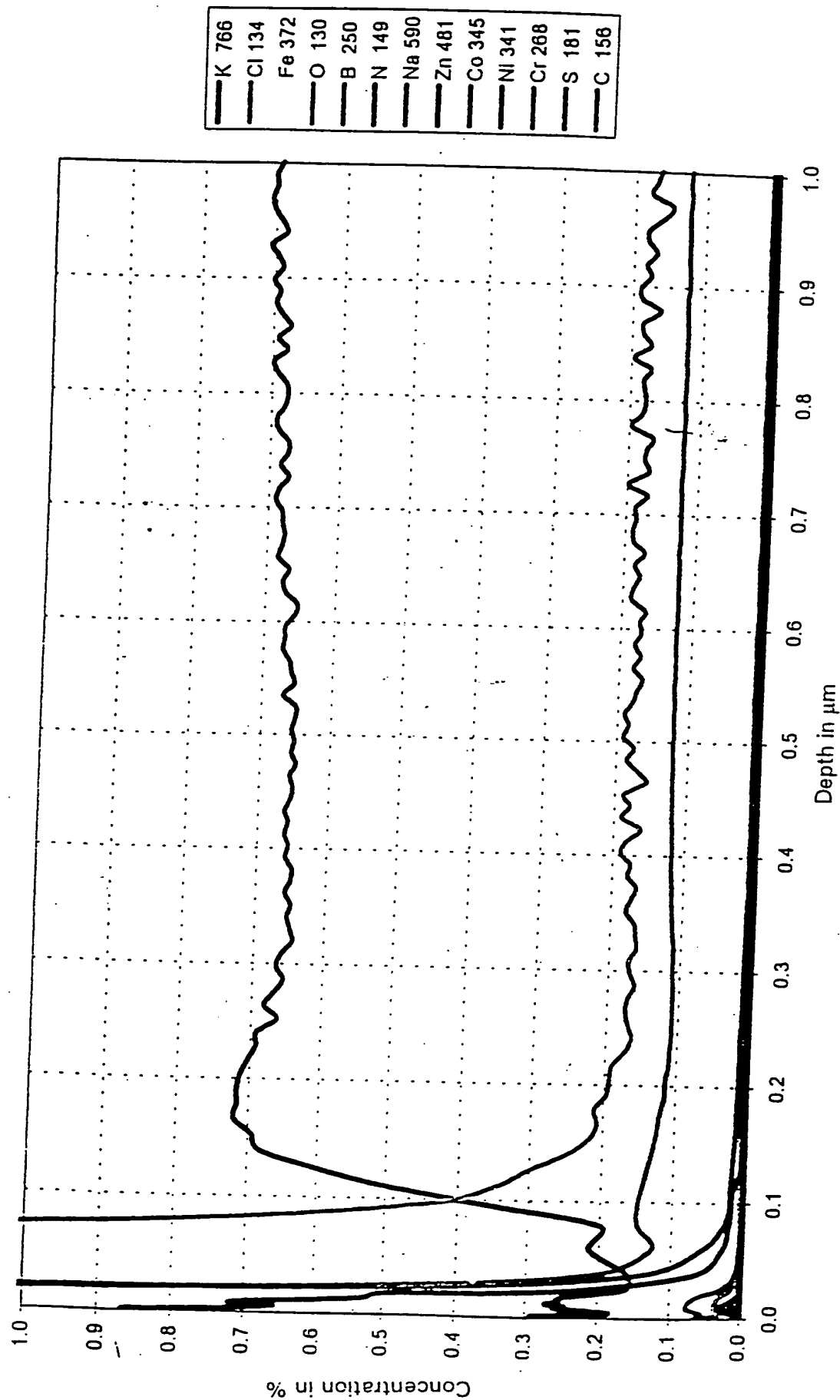


Diagram 2

Sample 8, Measurement Position A



—	K 768
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 288
—	S 181
—	C 156

FIG. 33
T001540000

Sample 9, Measurement Position A

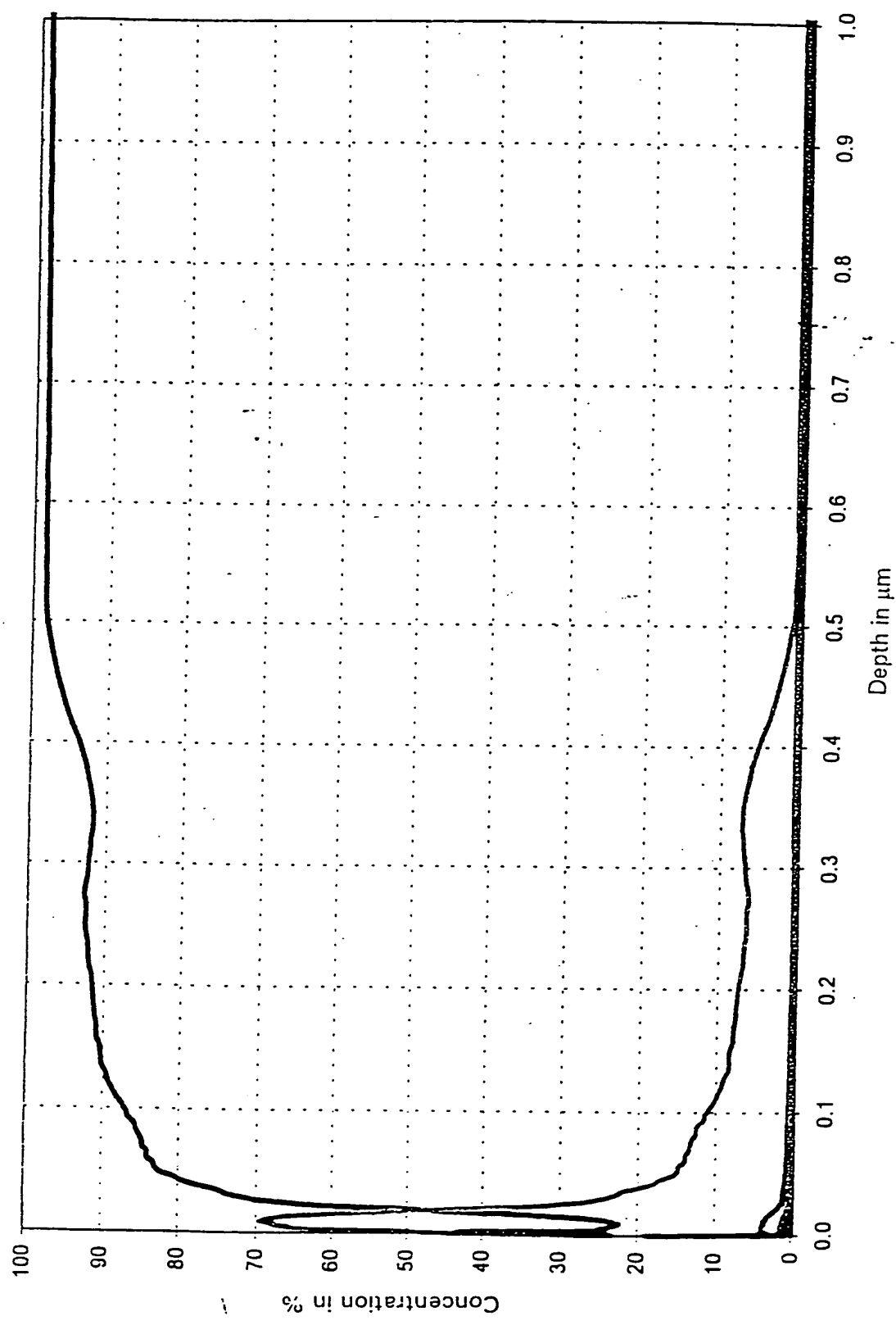


FIG. 34

Sample 9, Measurement Position A

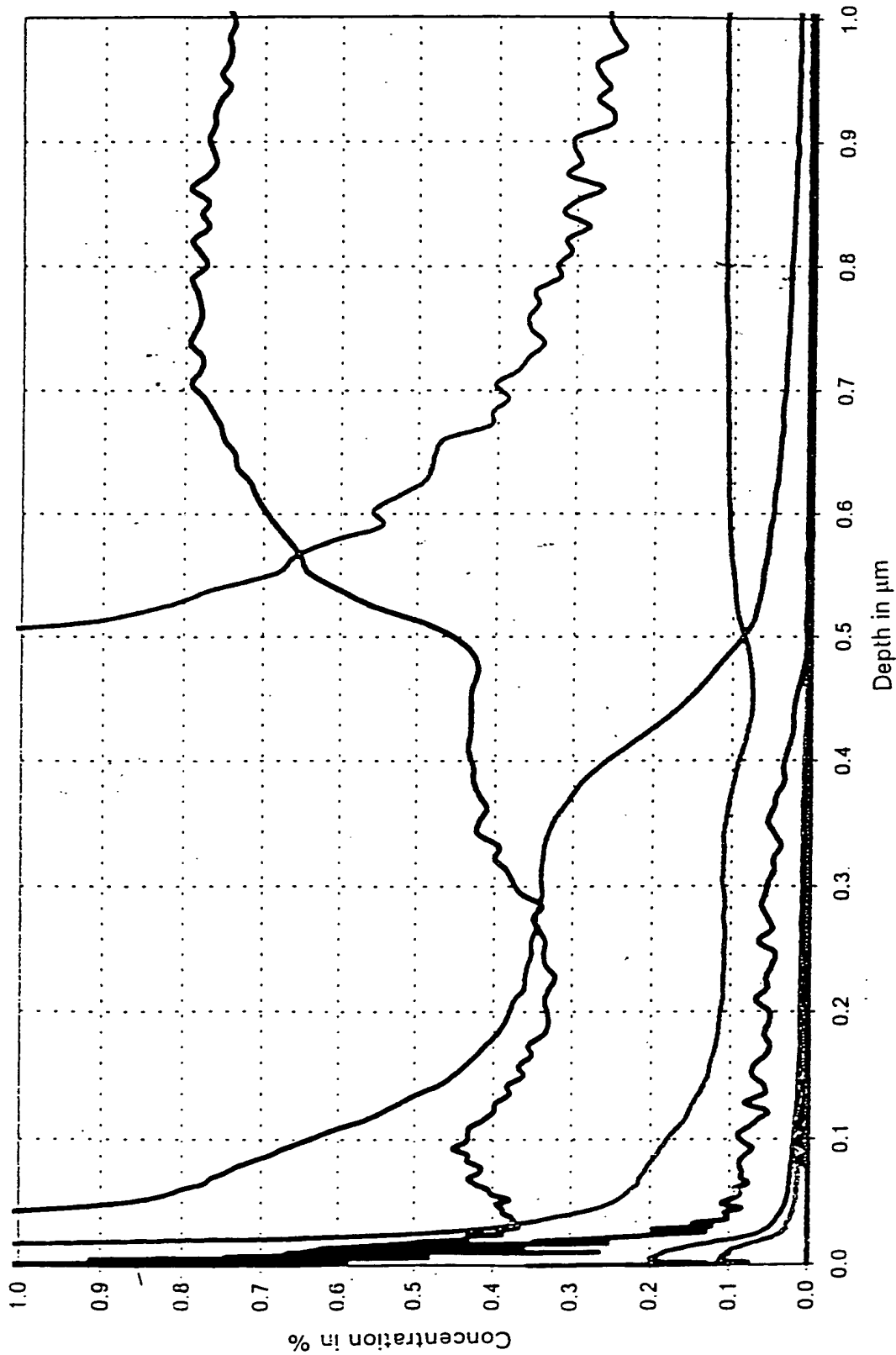
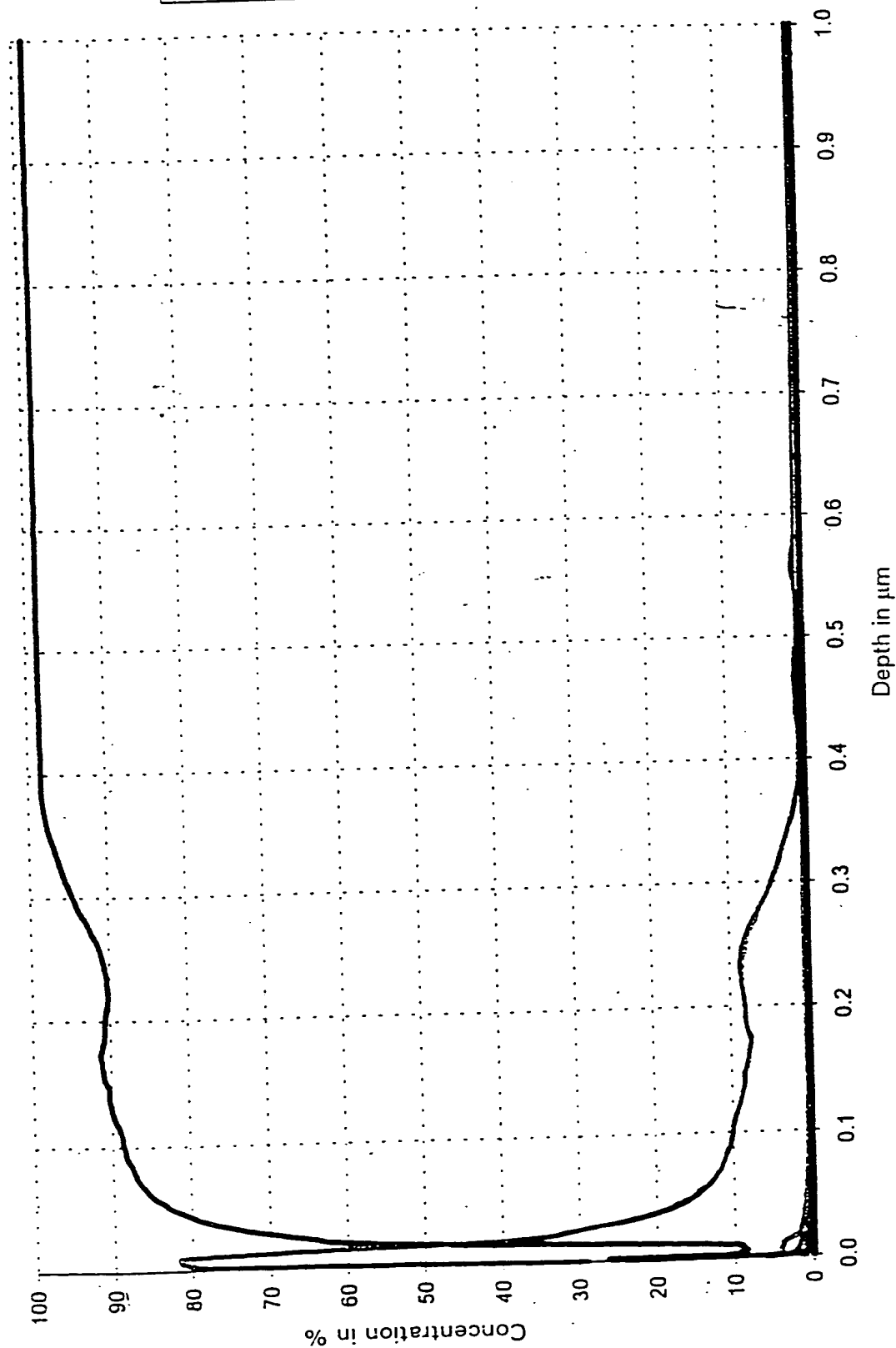


FIG. 35

Sample 9, Measurement Position B



35/38

—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 156

Sample 9, Measurement Position B

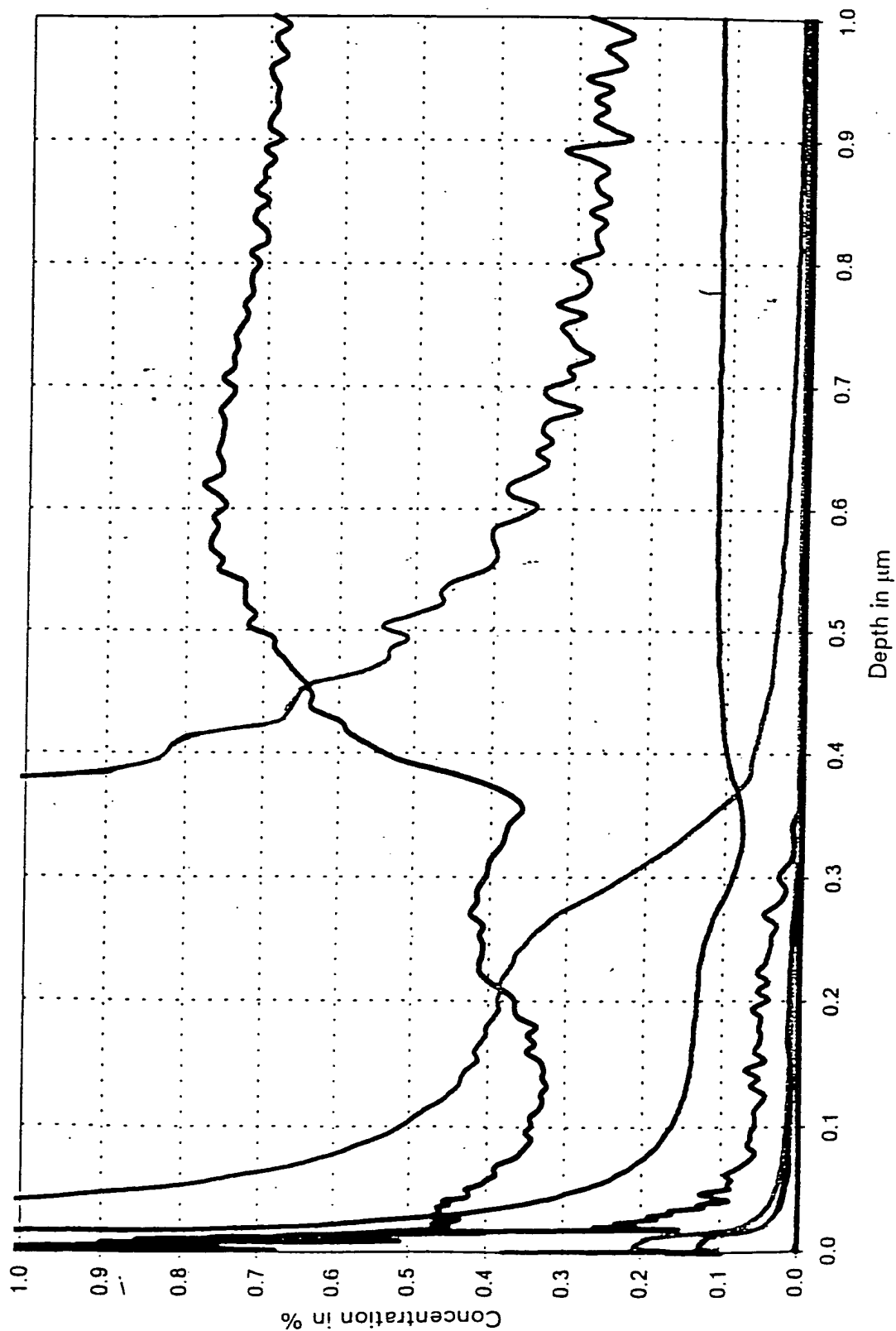
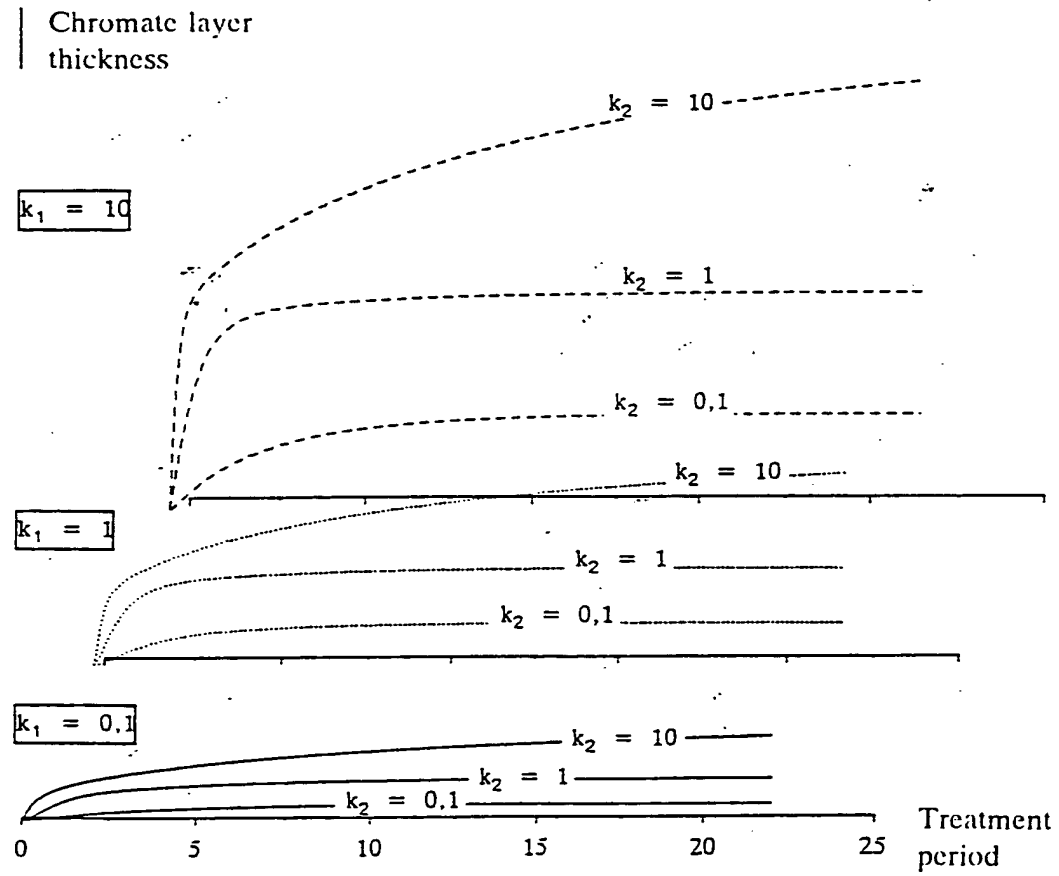


FIG. 37

	Methods					
	Ellipsometry nm	SEM nm	Glow-discharge nm (Cr > 1%)	spectrometer with Cr (%)	chromium index nm (Cr > Zn)	nm (Cr > 30%)
1. Prior Art						
Yellow chromation Cr(III) + Cr(VI)	-	300	440	11	48	25
Blue chromation Cr(III)	98	60	60	8	5	0
2. Invention (Chromitization)						
60 °C Cr(III)	432	300	344	7	23	15
100 °C Cr(III)	595	-	358	10	38	28
60 °C on Zn/Fe Cr(III)	-	-	282	6	16	0
100 °C, two-fold concentration Cr(III)	953	-	-	-	-	-
						1,2,3,4,5
						6
						7

Fig. 38

38/38



Computer simulation of the kinetic model of chromate coating of zinc for various rate constants